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Hyperthyroidism—Prognosis and Treatment

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My aim in presenting this paper is to set forth in concrete form the salient features that lead to an accurate estimation of the severity of any given case of hyperthyroidism. Treatment must needs be discussed in conjunction with prognosis, since the patient's response to treatment determines the gravity of this malady. The clinical features herein delineated are discussed in the order of their magnitude in both diagnosis and treatment. It is to be emphasized that no one clinical phase dare be ignored when attempting to decide upon the continuation of medical treatment, roentgenotherapy or the employment of surgery. Patients can be carried throughout the course of their illness with the greatest safety when they are considered from the onset as being both medical and surgical in nature. Irrespective of how mild the symptoms may be, over a period of several years, the patient may at any time develop severe symptoms that call for surgical intervention.

Important among the factors to be considered in a clinical evaluation when establishing a prognosis in any given case of hyperthyroidism are:

DURATION

In event of thyroid toxicity having existed for a year or more, this is sufficient to cause the clinician to proceed cautiously. Death rarely follows surgical intervention in persons where thyroid toxicity is recent (not over one year); and medical therapy is efficient in most recent cases of this variety of thyroid imbalance.

LOSS IN WEIGHT

Underweight, for height and age, is an unfavorable feature. A patient over 40 years of age in whom the net weight does not exceed 100 pounds (45 kilos) is by this feature alone placarded an unfavorable risk, irrespective of whether the treatment is to be medical or surgical. A rapid loss in weight of from 20 to 40 pounds (9 to 18 kilos) or more during the past year is reliable evidence of serious thyroid intoxication. Extreme emaciation, even in patients where the exact loss in weight is unknown, furnishes ample cause for a guarded prognosis.

PETECHIAE

Petechiae about the mucous surface of the mouth constitute a warning of no little prognostic omen. Petechiae are seen on the inner surface of the cheek opposite the molar teeth. These hemorrhagic areas are, as a rule, small, irregular in outline and often occur as irregular red streaks. They develop in successive crops, one or more minute petechiae appearing every few days. It is rather common for petechiae to occur about the frenum of the tongue, in which situation their outline is circular.

A married woman, age 40, youngest daughter 9 years old, treated in the College Hospital in 1929, developed successive crops of petechiae on the buccal mucosa for a period of three weeks after entering the hospital. She gave clinical evidences of a high grade of thyrotoxicosis. Her pulse was usually 140 and the rate of the heart could not be estimated by placing the stethoscope over the organ, due to extreme irregularity. This woman had lost 40 pounds (18 kilos) during the past year; and the metabolic rate was from 40 to 50 above normal on admission to the hospital. A thrombocyte count gave

102,000 on admission, but rose to 254,000 before operation. She was rather obstinate in her response to iodine therapy, but in due course of time the petechiae did not reappear, coincidentally with a subsidence of all annoying symptoms.

Lobectomy was performed by Dr. Hubley Owen, and the patient went on uneventfully to recovery. Petechiae when present serve as a special warning against extensive surgery. Patients who display petechiae of the mucous surfaces do not respond well to surgical intervention and withstand hemorrhage badly. A careful study of the blood platelets is necessary. Several counts (at 3 day intervals) are required to establish a reliable average count. The secondary anemia of thyroid disease bears the same significance as when accompanying other conditions.

Metabolic Rate

A study of the metabolic rate serves as a fairly true guide to the degree of thyroid toxicity. Whenever it is impossible to reduce the metabolic rate to within 20 points above the normal the prognosis is exceedingly grave, such gravity depending directly upon the metabolic readings. The reduction of the metabolic rate by treatment (discussed later) is not alone sufficient to insure safety for operation in persons after the 40th year. The metabolic reading does not give a reliable estimate of the patient's ability to withstand surgery. Pole ligation, only, gives dependable information in regard to the patient's tendency to shift into the thyroid crisis. Whenever a fall of 3 to 5 points every three days is accompanied by a slowing of the heart rate, and improvement in nervous symptoms, the case is progressing favorably.

Anorexia

It is rather common to encounter acute, highly toxic cases where the intake of food is too small, and wholly inadequate for body maintenance. Later in the course of chronic hyperthyroidism there are often gastro-intestinal disturbances where anorexia is one of the most annoying features. Anorexia, diarrhea, and vomiting, together with a high metabolic rate, are of grave prognostic significance and unless rest and treatment are capable of controlling these symptoms the case leads rapidly to a fatal termination. Surgery is not to be considered during an exacerbation of annoying gastro-intestinal features. All authorities agree that whether the line of treatment is to be medical, surgical or roentgenological, a full diet is essential. In patients displaying evidence of a well marked thyrotoxicosis rest is necessary.

Iodine Therapy

It was in 1923 that Plummer disclosed the characteristic action of iodine when administered to persons suffering from what we designate hyperthyroidism. The response to iodine therapy is a specific one for exophthalmic goitre, since iodine exerts no appreciable effect on either man or animals where the symptoms are caused by the feeding of thyroid. In purely adenomatous goitre with hyperfunction the result of iodine therapy is *nil*, or, at most, the advantages of such treatment are questionable. The writer has never been able to show conclusively that iodine aggravated the symptoms in any form of goitre.

What iodine therapy accomplishes in thyroid hyperfunction is unmistakable, but I am not aware of any physiologic research that enlightens us with regard to how this end is achieved. Potter and Coller conclude from their studies of thyroids removed following iodine treatments: (a) There is an absence of hyperplastic zones; (b) some augmentation of the colloid substance; (c) the alveoli are developed beyond normal; (d) the organ is less friable and bleeds less readily when incised.

Persons suffering from Graves's disease display a phenomenon which is characteristic and diagnostic. There is a rapid therapeutic response, e. g., improvement in all nervous symptoms, slowing of the patient's movements, lessening in pulse rate, return of the heart's action to normal, with the disappearance of auricular fibrillation, lessening of attacks of palpitation, and a lowering in the metabolic rate[1]. Whenever the initial iodine treatment is not followed by the above response the case is not one of true Graves's disease.

The therapeutic response is influenced by geographic location of the patient and by the degree of toxicity. The improvement is more apparent in well developed cases than in mild ones, or in those who have previously taken iodine or received *x*-ray therapy, or in patients residing in a goitrous area. The stage of the disease when iodine is given may cause the medicinal response to vary widely. Iodine, whenever administered, reduces the thyrotoxicosis as is shown by an amelioration of all the annoying symptoms.

Iodine therapy has but a moderate influence on the duration of advanced cases of hyperthyroidism. When exophthalmus exists, its influence on the course of the malady is unapparent. Iodine lessens the severity of the symptoms and thereby serves in preparing the patient for surgery. A patient may show increasing thyrotoxicosis while taking iodine, but this phenomenon is not due to iodine therapy. It has not been my experience to treat a patient suffering from exophthalmic goitre who was intolerant to iodine administered orally.

Dosage

The dose will vary with different patients, from one-half a drop per day to ten drops of the compound solution of iodine three times a day (the solution should be taken through a glass tube). In many instances the large dosage is unnecessary, although it never does harm. To combat an acute thyrotoxic crisis prudence warrants the large dose. There are patients where little or no response is observed until 20 to 45 drops of the compound solution are taken, in divided doses, every 24 hours. The compound solution of iodine may be given per rectum in doses of from 5 to 10 minims, well diluted in cold water or milk, two or three times daily. Repeated small doses are preferable.

Preparation For X-Ray and Surgical Treatment

The preoperative medical course of treatment may vary slightly according to different internists and surgeons. Essentially it consists in: (a) Rest in bed, in a quiet room, with as perfect release as is possible from family and business worries. (b) A liberal diet. (c) The administration of compound solution of iodine in doses of ten minims (well diluted) for each 150 pounds of body weight, three times daily after food. (d) Stimulants are to be avoided in so far as is possible. (e) I have found that digitalis is of questionable advantage in regulating the heart and dispelling the auricular fibrillation. Digitalis when employed during the preoperative treatment tends to give the heart action a false buoyancy and thereby often conveys a wrong impression regarding the extent of surgery that is warranted. Surgery offers more where the symptoms and signs of hyperthyroidism are controlled by iodine, and in cases where digitalis therapy can be withheld for postoperative use. Iodine therapy is not to be regarded as displacing pole ligation; on the contrary, it only makes any form of surgery the safer.

Limitations of Surgery

The extent of operation is to be included in the reckoning of surgical risks. Stage operations and pole ligations give the lower mortality; and are not followed by

postoperative exacerbations, as a rule. Postoperative crises spell too extensive surgery. Dealing with the problem from the standpoint of the internist it appears that the condition of the patient while under operation is too often misleading. A patient may be in good condition on leaving the operating room and pass rather hurriedly into a thyroid crisis. It is only through painstaking study of the clinical history, course before specific treatment, and response during *x*-ray treatment and while under iodine therapy that one is able to estimate the approximate extent of surgery that will be safe for each given case. During operation the blood pressure is of inestimable clinical import, since a pulse pressure of 100 or less is a good omen. A pulse pressure above 100 is a warning to discontinue surgery—but after middle life the rate of the pulse and the pulse pressure are not wholly dependable.

Postoperative Difficulties

Postoperative residual thyrotoxicosis may develop directly after or a few weeks later, following subtotal thyroidectomy, and even following less extensive operations. The metabolic rate may not be greatly disturbed in these cases. Iodine is indicated in all cases of residual thyrotoxicosis. The dose required is usually small; however, regulate the dose in accordance with the symptoms. Patients in whom iodine exerts no favorable influence will probably develop a new growth in the remaining thyroid.

Bier[2], in his studies of the blood from hyperthyroid cases before and after surgery, found that the total iodine content was reduced from 5 to 10 per cent following surgery. Bier concludes from his investigations that the severe postoperative reaction is not the result of an over supply of thyroidal secretion in the blood stream, but depends upon an acute and sudden decrease in the blood, thus regarding the thyroid crisis as a truly hypothyroid shock.

Thyroid Crisis

An acute exacerbation in all thyrotoxic symptoms marks the thyroid crisis. Fright, mental anxiety, the injection of epinephrin, radiation, surgical operation, hemorrhage, undue trauma to the tissues about the thyroid and prolonged ether anesthesia appear to encourage the crisis. A crisis is to be feared following thyroid operation on patients during early adult life—before the twenty-fifth year; and in older subjects who have recently suffered a rapid loss in weight, present a high metabolic rate, and exhibit auricular fibrillation; and in any case of hyperdysfunction that has not previously been prepared through the use of iodine.

Crile[3] claims the thyroid crises can be precipitated by any one of eight factors, six of which originate within the body: (1) emotional excitation, such as fear, anger, worry, etc.; (2) foreign and split proteins, such as infection, wound secretion, etc.; (3) asphyxia; (4) hemorrhage; (5) pain; (6) physical exertion. The two artificially produced factors are: (1) the induction of inhalation anesthesia, and (2) the injection of adrenalin.

Mental excitability following surgical operation may advance rapidly to delirium, restlessness, mania, tachycardia, coma and death. The pulse rate during the crisis varies between 160 and 200 per minute, and the temperature rises rapidly to 105, 106 or 107, resembling in this respect the thermic features of sun stroke.

Dehydration is the most dangerous feature during the crisis and is best controlled by the administration of from two to four liters of fluid by hypodermoclysis during each twenty-four hours. During the attack glycogen is exhausted with great rapidity and fats are but partially burned, which disturbances of metabolism are followed by acidosis. Glucose should be given intravenously as a means of combating hypoglycemia. The average patient, according to Foster, requires approximately 100 grams of glucose during each twenty-four hours. A 50 per cent solution of glucose should be administered in doses of 20 grams every 3 to 4 hours. Glucose solution administered by bowel I have found to be valueless. The nervous symptoms are best controlled by morphine in doses of ¼ to ½ grain, hypodermically. Hyoscine, grain 1/100, phenobarbital (luminal) grains 1½ and barbital grains 5 have been employed by various writers in treating the nervous manifestations of the thyroid crisis. Compound solution of iodine is to be given liberally in doses of not less than 10 minims, well diluted in water, three times during each 24 hours until there is a decided amelioration of the nervous symptoms.

Mild Hyperthyroidism

There are patients where the degree of thyroid dysfunction is slight, and in whom only a few of the cardinal symptoms and signs are present. Selected cases may, through the use of small doses of iodine (while continuing their usual duties), experience a lessening in the size of the thyroid, gain in weight, slowing of the heart rate and a stabilization of the nervous system. Many of these cases enjoy health for years, and may never experience a return of the thyroid trouble. Thyroid dysfunction of the exophthalmic type is prone to remissions and exacerbations, therefore, all patients must be watched carefully over a period of years. A young woman between the twentieth and thirtieth years may display mild evidences of thyroid dysfunction which are readily controlled by iodine therapy, and the patient enjoys health until about the fortieth year, when there is likely to be a return of the nervous symptoms. At the menopause patients of this class are again liable to another outbreak of thyroid symptoms. It has been my privilege to follow many of these so-called mild cases and I am convinced that the majority of them go through life unconscious of any thyroid annoyance. The practical point is that these cases are relieved and may be cured by thyroid therapy.

Conclusions

In all cases where hyperthyroidism has existed for one year or longer, caution should be heeded with reference to any radical procedures in connection with treatment. Underweight or a loss of from twenty to forty pounds during the year renders the prognosis exceedingly grave. Thrombocytopenia and secondary anemia are clinical features that should be corrected before the employment of roentgenologic therapy or surgery. While the metabolic rate is a fair guide to the clinical progress of a case and to the effect of treatment, it gives no estimate as to the patient's ability to endure either roentgenologic treatment or surgery. Gastro-intestinal symptoms, when present, are of serious prognostic significance.

Iodine therapy serves as the most reliable line of treatment in cases of mild hyperthyroidism and is a dependable method in the preparation of patients for surgery. The therapeutic response of the patient to the oral administration of iodine is of both diagnostic and prognostic value. The dose of the compound solution of iodine varies within wide limits in the hands of different clinicians. The stage of the disease, geographic residence of the patient and the severity of the symptoms are factors that dictate the dosage. It is unsafe to place any patient suffering from hyperthyroid activity under either roentgenologic or surgical treatment until after they have been prepared by iodine therapy.

Stage operations and pole ligation serve as the only

(*Continued on page 356*)

Morbid Impulse, Criminal Act and Mental Responsibility*

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The question of responsibility of persons presenting morbid impulses is of the greatest moment from a social and medico-legal point of view. It is frequently accompanied by difficulties, and has led not infrequently to many judiciary errors.

Primitive society recognized crime as a punishable act, irrespective of any other consideration. The criminal was always punished, no matter what his mental state was. Ancient legislation ignored entirely the question of irresponsibility. The Romans were the first who distinguished between compos and non-compos mentis. But the great difficulty was to determine under what condition an individual ceases to be compos mentis. Prejudices, errors of all sorts, religious and political passions interfere with the proper understanding of cerebral functions, of impulses. These persons may be fully aware of the illegality of a certain act; they may fully realize that murder, assault, arson, deception, which they commit, are normally wrong and punishable by law, and yet they cannot, by reason of the very nature of their mental inferiority, be held totally accountable for their actions.

The medico-legal literature is abundant with examples of indiscriminate conviction of this category of persons. Notwithstanding the considerable work of the psychiatrists, the incessant labor of the profound students of psychology, and the evident and flagrant injustice to mankind, some jurists are loth to accept the humane and scientific principles laid down by the workers in this field of human knowledge. It is, of course, proper to advise, as they do, to moderate the passions and to learn to control them, but this is possible only for a brain free from any hereditary or acquired taint.

When an expert is called upon to give his scientific opinion on crime committed under the influence of an irresistible impulse, he has to consider not only the crime but also, and mainly, the criminal. As to the criminal, it must be determined whether he is an insane or only a psychopathic or mentally defective individual affected with obsessions and morbid impulses.

The problem of the determination of the degree of culpability of a person who has committed an antisocial act is sometimes associated with great difficulties. A variety of factors may enter into solution of this problem. An illegal act may be committed accidentally or unexpectedly and independently of the person's will. It may be committed under an unavoidable necessity, such as in cases of protection of one's self or one's family. It may be committed under the influence of extreme passion or anger, when consciousness becomes blurred and cerebral inhibition is obliterated. It may be committed by insane persons whose delusional ideas, accompanied or not by hallucinatory images, develop morbid impulses of deliberate and well planned criminal tendencies. Finally, illegal acts may be committed by those who, though not insane in the strict sense of the word, are nevertheless different from normal persons by their power of reasoning, by their sentiments, tastes, sympathies, etc. To this class belong the large category of psychopathic individuals, also the mental defectives.

We will be concerned here exclusively with the medico-legal aspect of morbid impulses in psychopathic persons and in mental defectives, with the object of determining the degree of their responsibility. In such cases there is a genuine medico-legal problem to be solved, while lunacy, by the nature of the profound mental disorder, excludes all possibility of discussion. Let us consider the cause of the existence and the development of impulses in the first category of our group.

The study of morbid impulses in psychopathic persons is very important because of the grave consequences to which they may lead from the social viewpoint, and because they constitute episodic manifestations in the life of such individuals.

What is psychopathy? Under this term is understood a pathological state of an individual whose psychophysical resistance is constitutionally diminished; in other words, it is a condition which is a deviation from the normal type of humanity. In such a person there is an interruption of harmonious equilibrium existing between various functions of cerebrospinal centers; the co-operation and adaptation of these centers are incomplete. There is an ataxia of thought, of sentiment, of will, of psychomotor functions.

According to the parts involved, these patients form several groups which are only apparently different from each other, but under which is hidden the same individuality, viz., the psychopath. Such individuals are only partial, incomplete beings. They may have a remarkable memory but they cannot fix their attention. Their mental instability is sometimes extreme. At the same time they may be eccentric, dreamers, with romantic tendencies. They are emotional, timid, extremely sensitive, impressionable, suspicious, egotistical, haughty, and may be affected with moral perversity of the gravest nature. The best illustrations of the loss of psychical equilibrium is found in obsessions and morbid impulses. The latter is the consequence of the first.

What is an obsession? Normally, an idea, a sentence, an image, may unexpectedly invade our mind and obstinately persist. It is sufficient, then, to exercise our will to a certain extent and make this phenomenon disappear. This, so to speak, physiological obsession, never leads to a morbid impulse. When a morbid obsession occurs, the cerebral centers are invaded by a certain image or idea, which remains fixed, and suppresses subsequently all antagonistic images or ideas. This is accomplished not without a struggle, but the tenacious idea is accompanied by a moral pain so intense that it subordinates the will, and the individual, perfectly conscious of what is going on, but powerless, finds himself irresistibly forced toward acts of which he himself disapproves. The obsession leads to an impulse and these two phenomena are in the same relationship as a thought to the act.

In a psychopath who becomes fatigued, whose nervous system becomes exhausted, there may develop obsessions and morbid impulses. Depressive emotions, prolonged intellectual effort, a prolonged waking state, excesses of any sort, abundant hemorrhages, protracted infec-

*Address delivered on October 28th, 1930, before the Medico-Legal Society of Philadelphia.

tious diseases, disturbances of nutrition, intoxications, especially alcoholic, the sight of a capital punishment, the news of a suicide or homicide, the recital of a murder, are all provoking causes of morbid impulses in a psychopathic individual.

In making a diagnosis in patients of this order, it should always be borne in mind that morbid impulses for minor offenses are frequent in the psychopathic individuals.

In determining the nature of and the motive for morbid impulses, only a prolonged and thorough examination will help to form an impartial opinion. Let us briefly emphasize the distinctive points as they are essential for a proper conception of these interesting phenomena.

When a lunatic assassinates, he is under the control of a delusional conception and hallucinations or illusions, by which he is carried away towards the abnormal impulse. The latter has a special character, viz., unconsciousness of the act; automatism is the essential feature.

When a morbid impulse is the result of an obsession in a psychopathic individual, the characteristic features of the act are—the lucidity of consciousness, the tormenting mental struggle before the act is accomplished, the realization of the horror of the act. At the same time the state of anxiety of the patient is accompanied by cardiac palpitation, acceleration of the pulse, headache, tremor, perspiration, etc. All those symptoms occur in an individual whose mentality is abnormal, irregular, asymmetrical and without equilibrium. In such a person also the soma will frequently be found deviated from normal; there will be present many stigmata of physical degeneration, disturbed functions of the viscera, of tissues, of organs. A profound study of his own life, of his reactions to external and internal stimuli, of his adaptability to surroundings, also of his family history, of the hereditary features—such a study is indispensable in making a diagnosis.

Before dismissing the subject of psychopathy, I wish to emphasize the fact, that the present discussion is concerned exclusively with its medico-legal aspect. The purely psychological angle has not been touched. The latter would have formed a most interesting chapter, as it would have dealt with the real interpretation of the various impulsive acts just described. A psychoanalytic survey of the symptoms is most fruitful for an understanding of motives, reason, and causes of morbid or unusual acts. But the presentation of the subject under discussion has obviously a different purpose.

Psychic Factors of Mental Defectives

Let us now consider briefly the psychic forces in mental defectives which may lead to obsessions or morbid impulsive acts.

In considering all varieties of mental deficiency we find a long scale beginning with mental monstrosities and ending with slight mental feebleness. When the intellectual powers are involved in their entirety, we deal with idiocy. When the arrest of mental development is only incomplete and is, therefore, compatible with the existence of some intellectual manifestations we deal with imbecility. There are also those in whom only certain powers are likely to reach a degree of development; in whom there is no general, but only partial defect of intellectual power. This category of individuals manifests a conspicuous inequality of development of various intellectual powers.

From the viewpoint of mental responsibility before the law, it would be superfluous to dwell at length on the idiots. The complete absence of intelligence, of moral conceptions, of sensibility, places an insurmountable obstacle between idiots and the exterior world.

In imbecility we find rudiments of intellectual and moral development. The intellectual niveau is somewhat higher than in idiots which, therefore, permits certain acquisitions. With considerable amount of patience, perseverance and ingenuity one may succeed in training imbeciles to a certain degree. In the sphere of morality the imbecile exhibits instinctive tendencies of a low order. Cruelty, vanity, gluttony, masturbation, sexual perversion, excesses of all kinds, cowardice, unusual irritability, are all characteristic of imbeciles, and these characteristics lead frequently to all sorts of abnormal acts. Theft, arson, brutality, homicide, are not uncommon in imbeciles.

Following up the intellectual niveau one step higher than in the imbecile, we enter the domain of the large group of mental feebleness, the study of which is of considerably higher importance from sociological and legal viewpoints than that of idiocy and imbecility. Here we meet with a great many varieties and subvarieties, and the transition of one into the other is imperceptible. This is the most important chapter in the study of mental deficiency, as the number of such individuals is legion. We find them with us frequently; we deal with them in innumerable transactions; we find them on school benches, as well as in business life. Their relation to the community frequently results in harm.

This group presents, speaking generally, a mentality inferior to the normal in quantity and quality. Their intellectual development in both delayed and reduced. Thus, for example, the intelligence of a boy of twelve resembles that of a child of five.

In view of the enormous influence of intelligence upon the shaping of the normal personality, the resulting moral debility is to be expected in the category of persons which is the subject of the present study. It is a common observation that, apart from idiocy and imbecility, one of the chief characteristics of the feeble-minded is an obtuseness of conscience. The elements of the latter are too feeble in the struggle against passions. It may happen that the mentally deficient has some conception of right or wrong; he may feel that he does wrong, but he does not possess the aversion which would be characteristic of a normal person. The moral censors are not powerful enough; the voice of duty is not loud enough to be overcome by impulse. The want of judgment, of will, the weakness of character, render the moral personality of the feeble-minded unstable, not resistant, and thus they become an easy prey of their passions.

The majority of the symptoms referable to the deviations in the moral sphere gravitate around the ego of the mentally deficient. Thus, the ego becomes extravagantly accentuated. Egotism, consequently, is one of the most conspicuous symptoms of the entire picture. The mentally deficient individuals have no other thought but of themselves. Nothing moves them; nothing disturbs them except their own disturbances which they immeasurably amplify. Such a psychic orientation naturally leads to a dominating attitude and intolerance. Envy or jealousy is another derivation of egotism.

Among other typical features of mentally deficient individuals may be mentioned impulsive phenomena. They are spontaneous and involuntary psychic manifestations. Normally our acts are controlled by two factors—desire or an impulse for action on the one hand, and reasoning on the other. The latter controls and inhibits the former. When the intellect is impaired or defective, the impulse predominates and the desired act is executed, no matter how deleterious it may be; in such cases, we observe frequently sudden impulsive acts in which neither reasoning nor willpower intervene.

We have seen that the two important elements of the personality, namely, the intellectual and emotional, do no more preserve the parallelism of the normal individual. The intelligence being feeble, it has no more inhibiting power over the moral personality. Struggle against passions does not exist, or exists in a small degree. Impulsive acts are characteristic.

Pinel succeeded in convincing human minds that insanity was a disease and that there was no crime if the criminal was insane while committing it. Gradually the field of responsibility became wider and wider. The criminologists of the new anthropological school, and with them the psychiatrists and all students of normal and abnormal psychology, jurists and enlightened laymen, all admit now that a psychopath, as defined above, presenting episodic paroxyms of pathological impulses, cannot be considered fully responsible for his criminal tendencies and acts, and that, instead of being committed to prison, he should be removed from society and placed safely to undergo medical treatment.

As to mental deficiency, we have seen on the foregoing pages that besides a certain degree of intellectual inferiority there is particularly an inherent deficiency of inhibitory power. We nave seen that the whole life of mental defectives is composed of incidents of an instinctive nature, as the instinct predominates in them, and, therefore, their actions are invariably the result of mental activities. The impulses are no more under control of the cerebral centers which ordinarily regulate our actions; but they exercise their influence on the motor sphere by producing an excessive activity. In such cases naturally there can be no choice of action; each movement is the immediate result of sentiment. The acts are unconscious; they must be executed because they are out of the field of struggle which normally exists between reasoning and passion. The acts are, therefore, mechanical, automatic, and of a reflex nature.

Conclusion: The determination of the degree of responsibility of a criminal should, therefore, be placed in the hand of an alienist. Only he is capable to determine early stages of insanity; only he is able to determine apart from insanity the degree of mental control, of inhibitory power of a delinquent who presents mental stigmata of degeneracy.

There is a frequent conflict between medical and legal conceptions of insanity. The law admits that a man with one fixed delusion may be sane on every subject except when he touches upon the delusive thought, and some jurists consequently argue that he can be considered sane before or after a crime is committed, but insane during the act. From a medical viewpoint, such an argument is unscientific, for, if delusive ideas are apt to originate in a brain, the function of its constituent elements is certainly disturbed. In such a brain one certain delusion may be formed and remain fixed. but by the very reason of this fact this brain must be considered diseased and misconception with misinterpretations may become manifest at any moment. A person thus affected should by no means be considered "responsible before the law" before or after the crime.

When an individual conscience is not completely developed; when judgment and will power are wanting; when egotism is pathological; when envy and hatred are intense and directed towards the dearest and nearest; when impulsive tendencies are conspicuous; when a thorough appreciation of acts and meditation are intrinsically not profound enough to overcome instinctive tendencies; when all these phenomena characterize mentally deficient persons, phenomena which constitute an integral part of their abnormal make-up, the problem of mental responsibility may be solved without special difficulty. It requires no special stretch of imagination to see that those mentally inferior, such as depicted above, possess inferior and defective conceptions of right and wrong.

Those who create laws and those who administer justice view with very few exceptions only the social side of the law, and usually are not at all interested in psychological and medical studies which present a different concept of criminality and of the criminal himself. It is true that penal legislation and legal medicine are distinct and separate sciences, but positive criminology must rely on both branches of human knowledge. An intimate unity of these two sciences is an indispensable and an essential condition of progress. Criminology has for its object the formation of positive laws concerning crimes and the discovery of remedies for them. With this object in view, it searches the truth wherever it can be found, and takes from medical and legal sciences data which it needs to form a scientific foundation. By the union of the two sciences, the old and too narrow boundaries of human conceptions of liberty and responsibility will be broken and progress will be assured. Our present knowledge of normal and pathological processes in the psychic sphere and the proper appreciation of abnormal mental operations enable us to avoid errors in administering justice. To accomplish the latter, responsibility and irresponsibility must be viewed from the viewpoint of broader principles than heretofore. Human liberty and responsibility are two most serious elements of life that cannot be dealt with in a purely technical manner. In studying a crime we must distinguish two factors, viz., the conditions in which it was committed and the psychic characteristics of the author of the crime.

1812 Spruce Street.

Saskatchewan Grants to Doctors Provide Care for Sparsely Settled Areas

The problem of medical service for the sparsely settled areas of a new country is being solved in Saskatchewan by a system which provides for municipal doctors. Distinct progress has been made under a law which is slightly more than a year old.

Of Saskatchewan's 866,700 people, scattered over 251,700 square miles, 14.4 per cent live in the eight cities, 7.7 per cent in the eighty towns, 8.4 in the 377 villages, 65.3 in the 301 organized rural municipalities and 2.9 per cent in unorganized territory, the remaining 1.3 per cent being Indians on their reservations. Thus there is an extensive area needing medical service, but which makes little appeal to the young doctor seeking to earn an immediate livelihood and to establish himself professionally.

The new Rural Municipal act gives to every municipality the right to make a grant up to $1,500 annually to a legally qualified medical practitioner who is a resident or is easily accessible on call, or it may guarantee his income to that figure. The municipal doctor must give free medical service to indigents, and if necessary perform the duties of health officer. On the demand of twenty-five taxpayers, the council must submit a by-law to the electors empowering the council to engage a physician for full-time services at a salary not exceeding $5,000 a year.

Already, under this cooperative health measure, there are thirteen rural municipalities paying medical grants of from $900 to $1,500 annually. Nineteen other municipalities have engaged municipal doctors at salaries varying from $3,500 to $5,000 per year. The system is giving much satisfaction, for it guarantees to the physician a reasonable income and gives the settlers needed medical service.—*New York Times.*

Hyperthroidism

(*Concluded from page 353*)

reliable means of ascertaining the patient's response to surgery. Iodine therapy does not displace pole ligation. Postoperative difficulties, the thyroid crisis and therapy in connection with mild cases of hyperthyroidism have received special consideration.

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The Elements of the Bárány Tests*

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The request to read a brief paper on this subject came from the society at whose meeting this was read with the following thought in mind:—"While much is heard about the Bárány Tests by physicians outside of the field of Otology, very little is actually known to them of those tests. Should they wish to make use of them or request their employment, they do not even know the indications for them or what information could be derived from their performance." Hence, the following is a brief résumé including charts, which covers the subject for most practical purposes. This represents, in part, a summary of the course given to the graduate students in Otolaryngology at the Graduate School of Medicine, University of Pennsylvania.

Definition

The Bárány Tests are tests applied to the ear to elicit certain normal or abnormal reactions. They bear the name of Barany because he was the first to correlate the experimental work and to point out some practical applications. They are also called Vestibular Tests because the reactions to the tests depend upon stimulation of the vestibule, or more correctly speaking, the semicircular canals of the internal ear.

Principle Upon Which Tests Are Based and Methods of Their Employment

The principle upon which the tests are based is the irritation of the endings of the eighth nerve in the semicircular canals by some form of stimulation. The stimulation aims at making the endolymph flow in the canals in one direction or another, the effect of the stimulation being the carrying of impulses to the brain through certain pathways. The manifestations resulting from impulses are nystagmus, vertigo, past-pointing, falling, nausea and shock. If the pathways are normal, the normal manifestations will appear. If there is any interference with the pathways, anywhere from the inner ear to the brain, no reaction or only abnormal reactions take place. The form of stimulation employed is one which will cause the endolymph to flow. For instance, turning an individual will cause the endolymph to turn also and in definite directions. Chilling the bone of the canals with cold water will, as in other fluids, cause the endolymph to flow vertically with the change in temperature. Heating with hot water will change the current in the opposite direction.

The methods, therefore, employed consist of the ROTATION method by means of which an individual is turned in a special chair causing his endolymph to flow, and the CALORIC method in which cold water at 68 deg. F. is employed, douching the patient's ear with it until the reactions appear.

ROTATION METHOD. In this method the patient is placed in a special chair, and the head tilted with chin downward about 30 deg. This places the hortizonal canals in a position practically parallel with the floor. The latter position is most favorable for the proper flow of the endolymph. When the patient is first turned the endolymph by virtue of inertia lags behind but soon the friction in the canal overcomes this and the fluid catches up with the canal and flows in the same direction as the canal. When the chair is brought to a sudden stop the endolymph continues to flow, again by virtue of inertia, until friction overcomes it and causes the endolymph to stop flowing. The patient is best observed immediately after rotation while the endolymph is still flowing. The

* Read before the Medical League, Philadelphia, November, 1929.

CHART I

BARANY TESTS OF THE VESTIBULAR APPARATUS (ROUTINE)

Rotation

Test	*Normal Reaction*
1. Spontaneous	1. No nystagmus, vertigo, past-pointing, falling
2. Turn to right 10 times in 20 seconds, Head 30 deg. forward	2. Horizontal nystagmus to Left, 24 seconds duration
3. Turn to left 10 times in 20 seconds, Head 30 deg. forward	3. Horizontal nystagmus to Right, 24 seconds duration
4. Turn to right 10 times in 10 seconds, Head 30 deg. forward	4. Past points to right with each hand about 12 inches
5. Turn to left 10 times in 10 seconds, Head 30 deg. forward	5. Past-points to left with each hand about 12 inches
6. Repeat Tests 4 and 5 and ask patient (whose eyes are shut as they should be in all these tests) to say repeatedly in which direction he is turning, e.g., right or left.	6. Will feel himself turning in direction of rotation while turning; when chair is suddenly stopped he will think he is turning in opposite direction for 26 seconds. This indicates normal quantitative VERTIGO.

In the above tests the eyes should be closed and the horizontal canals only are tested, and both sides are tested at the same time. The vertical canals are not usually tested by this method, although that can be done by repeating the above tests with the head in such a position that will bring the canals into a nearly horizontal plane, e.g., 90 degree forward or 60 degree backward-reactions will take place accordingly. (see other charts)

Caloric

1. Douche right ear with water 68 degree F., head 30 degrees forward. Note length of time required to produce reaction.	1. Requires about 40 seconds douching Nystagmus will be rotary to the left Past-pointing will be about 8 inches to right with each hand Sensation of turning (vertigo) to left and tendency to fall to the right
2. After above has been quickly noted, bend head back 60 degrees and again note reactions.	2. Same as above except nystagmus is horizontal
3. Repeat 1 and 2 in left ear.	3. Same as in 1 and 2, but in opposite directions

The Caloric method tests each ear separately as well as the ver tical and horizontal canals separately. When head is inclined 30 degrees forward the vertical canals are tested, when 60 degrees backward the horizontal one is tested. Some time during the course of these tests, varying in degree with each patient, there is a certain amount of shock, pallor, nausea and perspiration, which is a normal reaction of the sympathetic nervous system.

manifestations, resulting from the flow of the current are taken into account, the direction of the flow of the endolymph being the determining factor in the reaction. The routine method and normal reactions to be expected are all tabulated in Chart 1 appended.

Caloric Method. In this method the endolymph is made to flow by means of the physical property of fluids to become heavier when chilled and is thus made to fall downward causing a downward flow of the endolymph. When hot water is used the reverse is true and the endolymph can be made to flow in the opposite direction, causing reactions opposite to those caused by cold water. Hot water is too uncomfortable for the patient and is not often used. In employing this form of stimulation the canals to be tested must be in the vertical position, so that when the head is upright the vertical canals are tested, and when the head is turned backward or forward the horizontal canal is placed in the vertical position and is thus tested. The normal reactions are described in Chart 1.

Another method employed to produce reactions is the Galvanic Current method of stimulation. It is not as universally employed as the other two but has its definite value. Its stimulation depends upon electric stimulation through the eighth nerve. One may thus differentiate an inner ear lesion from a nerve lesion. With a dead labyrinth rotation and caloric methods will not elicit any response while the galvanic current will, showing the nerve and pathways beyond to be intact although the labyrinth is dead. The quantity of current required to produce the reaction is here taken into account, e.g., it requires about 4 m.amp. to produce reactions in a normal individual. (G. W. Mackenzie). The negative galvanic current produces an opposite reaction to the positive current. The reaction here is also nystagmus and vertigo.

Anatomic Data

Anatomically, the internal ear consists of a bony structure having three semicircular canals placed in the three directions of space. In front of these is another compartment, the vestibule, and anterior to the vestibule is another chamber which is a long one and turned on itself 2½ times, forming the shape of a snail. Within the bony internal ear there is a duplicate—a membranous labyrinth. The latter is surrounded by fluid—the perilymph. The membranous labyrinth contains a fluid—the endolymph. It is the movement of currents in the endolymph that stimulates the nerve endings, the impulses being carried to the brain. It is not the fluid alone but a gelatinous material in the endolymph which makes contact with the nerve endings that causes stimulation. Thus in the cochlea, the part of the labyrinth devoted to hearing, there is the tectorial membrane that performs the function. In the vestibule or the central part of the labyrinth there are the otoliths which do the work. In the semicircular canals there is the cupola at the ampulated ends of the canals which makes contact with the nerve endings to produce stimulation. The otoliths sense external pressure—static. The semicircular canals detect kinetic pressure, that is, motion and its varying direction.

The semicircular canals, the most important from the standpoint of the tests, are six in number—three on each side of the head. They are placed within the petrous portion of the temporal bone and are so placed that each one is in a principal direction of space, e.g., horizontal or parallel with the floor, antero-posterior—more correctly at an angle of 45 deg. to the antero-posterior (sagittal) plane, and lateral—or rather at an angle of 45 deg. to the side to side (coronal) plane. Both vertical canals are at right angles to each other and they are both at right angles to the horizontal one. The posterior vertical is parallel with the petrous portion of the temporal bone and the anterior vertical is at right angles to it extending outward and forward. The posterior vertical on one side is parallel with the anterior vertical on the other side. If one wishes to understand the currents in the canal in motion he must visualize the position of the canals in relation to the planes of the head. The simplest way to visualize them is to remember the position of the petrous portion of the temporal bones in the skull. Imagine a line bisecting the skull antero-posteriorly, then another from side to side; then the petrous bone is in the posterior half on each side running forward, making an angle 45 deg. to the antero-posterior line. Then remember that the posterior vertical canal on each side is parallel with the posterior surface of the petrous bone and the anterior vertical canals are at right angles to that surface and extending outward and forward. The horizontal canals, of course, are parallel with the floor. One should also know that the ampullated ends of the anterior vertical and horizontal canals are on the anterior end of the canal and the ampullated end on the posterior vertical canal is on its outer side with relation to the head. The position of the ampullated ends should be known as currents running to the ampullated ends cause different reactions than when currents flow to the non-ampullated ends. Chart II shows the normal reactions to the rotation and caloric methods with the head in various positions. It is the change in positions of the head which changes the plane of the various canals and the flow of the current within them. For example, in the first reaction, with the head upright, the ampullated ends are both anteriorly and when turned to the right (clockwise) the current in each canal flows to the right (clockwise), in the left toward the ampullated end (giving the stronger reaction, i.e., ⅔) and in the right side the current flows to the right—away from the ampulla (giving the weaker reaction, i.e., ⅓). The result—the current flows to the right in one uncomplicated direction, the eyes are drawn to the right (slow component), nystagmus or quick component to the left, past-pointing and falling to the right and vertigo to the left. (See physiological laws at bottom of chart II). The reactions from the vertical canals are not so simple to visualize as those from the horizontal canals. Here two canals are tested on each side not in exactly a horizontal plane but as nearly as possible so, and the reactions are produced by a resultant force from the two canals on each side. The nystagmus is therefore rotary instead of horizontal—a mixture of forces.

Experimental Notes

Flourens, in 1824, destroyed any one semicircular canal in pigeons and rabbits and noted uncontrollable movements of the eyes and head in the plane of the canal experimented upon.

Breuer, in 1888, produced similar phenomena, without destroying the canal, but by merely irritating it with chemicals, heat and cold and electrical stimulants.

Ewald, in 1892, experimented on pigeons, by making a minute opening in the canal in which he inserted a tubule connected to a rubber bulb. By compressing the bulb he produced movements of the head and eyes in the plane of the canal experimented on. Suction on the tube produced similar phenomena but in the opposite direction. Apparently this was accomplished by changing the direction of the current in the semicircular canal. Further experiments revealed that when the current was made to flow, in the horizontal canal, toward the ampullated end it produced greater stimulation than when the

CHART II

NORMAL VESTIBULAR REACTIONS IN VARIOUS PLANES

Rotation

Test	*Nystagmus*	*Vertigo*	*Past-pointing*	*Falling*
Turn to right, head 30 deg. forward	Horizontal to left	To left in horizontal plane	To right	
Turn to left, head 30 deg. forward	Horizontal to right	To right in horizontal plane	To left	
Turn to right, head 60 deg. back	Rotary to right	To left in horizontal plane and sensation of falling to right when head is brought up	To right	To left—getting upright
Turn to left, head 60 deg. back	Rotary to left	To right in horizontal plane and sensation of falling to left when head is brought up	To left	To right—getting upright
Turn to right, head 90 deg. forward	Rotary to left			
Turn to left, head 90 deg. forward	Rotary to right			
Turn to right, head 120 deg. forward		To left in horizontal plane and sensation of falling to left when head is brought up	To right	To right—getting upright
Turn to left, head 120 deg. forward		To right in horizontal plane and sensation of falling to right when head is brought up	To left	To left—getting upright
Turn to right, head to right shoulder	Vertical down		Up when head is brought up	Backward—getting up
Turn to left, head to right shoulder	Vertical up		Down when head is brought up	Forward—getting up
Turn to right, head to left shoulder	Vertical up		Down when head is brought up	Forward—getting up
Turn to left, head to left shoulder	Vertical down		Up when head is brought up	Backward—getting up
Turn to right after head is turned 45 deg. to right and inclined to right shoulder (90 deg.)	Oblique down to left when head brought up			
Turn to right after head is turned 45 deg. to left and inclined to right shoulder (90 deg.)	Oblique down to right when head brought up			

Caloric

Cold water 68 degrees F.				
Douche right ear head 30 deg. forward	Rotary to left	Sense of falling to left	To right	To right
Douche left ear head 30 deg. forward	Rotary to right	Sense of falling to right	To left	To left
Douche right ear head 60 deg. back	Horizontal to left	Sense of falling to left	To right	To right
Douche left ear head 60 deg. back	Horizontal to right	Sense of falling to right	To left	To left
Douche right ear head 120 deg. forward	Horizontal to right	Sense of falling to right	To left	To left
Douche left ear head 120 deg. forward	Horizontal to left	Sense of falling to left	To right	To right
Hot water 112 degrees F. Douche in above positions	Opposite to cold	Opposite to cold	Opposite to cold	Opposite to cold

The above reactions are in accordance with the following physiological laws:
1. The eyes are always drawn (slow component) in direction of endolymph movement (nystagmus is opposite)
2. Vertigo is always in a direction opposite to the endolymph movement.
3. Past-pointing always in a direction opposite to the vertigo.
4. Falling is always in a direction opposite to the vertigo.

current flowed away from the ampulla. The reverse was true in the vertical canals.

Bárány closely observed and systematized the phenomena previously noted, that irrigating the ear produced vertigo and nystagmus. He noticed that both the vertigo and nystagmus were of definite character and that hot water produced an opposite reaction to that of cold water.

Clinical evidence has been gradually accumulating which indicates that certain lesions produce disturbances in the normal vestibular reactions. Many of these lesions have been demonstrated at autopsy. At least one set of fibres has been demonstrated histologically by Cajal to exist, which connect part of the internal ear (external horizontal canal) with certain nuclei in the pons and cerebellum.

Nomenclature

Certain terms are employed in speaking or writing about the vestibular tests which will be briefly defined.

NYSTAGMUS. The to and fro motion of the eyes resulting from either experimental stimulation of the inner ear or certain pathological conditions.

AFTER-TURNING NYSTAGMUS. The nystagmus observed in testing by the rotation method and seen after the chair has been stopped. This is so qualified because the nystagmus during rotation is not easily observed and is in opposite direction to the one seen after turning. The after-turning nystagmus is noted because of convenience.

VESTIBULAR NYSTAGMUS. Refers to the type of nystagmus observed in experiment or disease involving the vestibular apparatus in contradistinction to ocular nystagmus which is due to some lesion in the eye or its nerve tracts. Both types differ in character.

QUICK COMPONENT AND SLOW COMPONENT OF THE NYSTAGMUS—The vestibular type of nystagmus has two

components, the slow drawn out motion of the eyes spoken of as the slow component and the quick recoil spoken of as the quick component. When nystagmus is spoken of, the quick component is usually meant as it is the easiest observed. Ocular nystagmus has no two components. It is oscillatory in character. The vestibular type is accompanied by vertigo and ataxia and cannot be controlled by the patient's will. It is increased when the eyes are turned in the direction of the quick component and diminished when the eyes are turned in the direction of the slow component. Ocular nystagmus is always rotary in character (never horizontal or vertical), is increased when eyes are turned in any direction and can be considerably controlled by the patient's will. It is not accompanied by vertigo and ataxia.

Horizontal Nystagmus. Refers to the type in which the eyes move from side to side in the horizontal plane.

Rotary Nystagmus. Refers to the type in which the eyes rotate to and fro in the vertical plane around an axis which runs back through the centre of the pupil.

Vertical Nystagmus. Refers to the type in which the eyes move up and down.

Oblique Nystagmus. Refers to the type in which the eyes move in an oblique direction.

Exaggerated Nystagmus. This term is applied when the nystagmus is prolonged in duration or much larger than the usual excursion (amplitude).

Inverted or Inverse Nystagmus. This is a pathological condition and is so named when in making the tests the nystagmus is in opposite direction to the one normally expected, e.g., to left when it should be to right.

Perverted Nystagmus. Refers to the condition where there is a wrong type of nystagmus, e.g., rotary instead of horizontal, oblique or vertical when it should be to the right or left.

Conjugate Deviation. The turning of both eyes in one direction (slow component) and no recoil (quick component).

Amplitude. Refers to the size of the excursions of the eyeballs. They may be average size or very large or very short excursions. No definite significance has been ascribed to the variation in size. Attempts have been made to actually measure the size of the excursions by using a rule. (Geo. W. Mackenzie).

Vertigo. Is the sensation of turning experienced by the individual after experimental stimulation or because of pathological conditions. In making the tests the resulting vertigo is in a definite direction.

Past-Pointing. Refers to the inability of the patient to find a spot with his forefinger (his eyes being closed) which he has previously touched. He deviates or past-points either to the right or the left. A normal individual will have no difficulty in finding the desired spot. After stimulation, however, he will past-point in a definite direction.

Shoulder From Above. Refers to the test for past-pointing in which the forefinger is used to find the spot and using the shoulder joint as the fulcrum of the upper limb and attempting to find the area by first raising the arm above the head and bringing it downward to locate the point sought. Past-pointing may be tested from below up or from side to side and the lower limb may be used as well as the elbow joint or other joint as fulcrum. In each instance another part of the cerebellum is thus supposed to be tested. Ordinarily the arm alone is employed—shoulder from above.

Falling. Refers to the normal tendency of an individual to fall in a definite direction after turning or douching of the ear with cold or hot water.

Vertigo, past-pointing and falling may all be absent after stimulation in pathological conditions. They may also be observed in wrong directions.

Some Remarks on Technic

The technic of the Vestibular tests as routinely performed is recorded on Chart 1. The test employed is recorded on the left side and the normal reaction expected is recorded on the right side. The test and the reaction bear a corresponding number. First one must look for any abnormal spontaneous manifestations. Normally a person has no nystagmus while looking straight ahead although when the eyes are turned to the extreme right or left, up or down, a slight physiological nystagmus may be noticed occasionally. A normal person should suffer no vertigo nor have any tendency to fall nor should he deviate his finger when with his eyes shut he is permitted to touch an object and then asked to raise his hand above his head and find that object, his eyes remaining shut. A 24-inch rule is best used for the purpose of testing for past-pointing using the centre as the object to be found. If there is any deviation it can easily be measured in inches in either the right or left direction. To test for a tendency to fall as in a Romberg test, the eyes should be closed and the feet close together. Attempting to overthrow the patient while he is so standing tests the stability of the vermis of the cerebellum which controls the trunk muscle and pelvic girdle. The patient here is pushed to the left, then to the right and then forward and backward. If the vermis of the cerebellum is properly functioning the patient should offer good resistance to the attempted overthrow.

In employing the turning tests it has been found by experience that turning the patient ten times in twenty seconds gives the most satisfactory reaction for the observation of the nystagmus. A little faster turning, ten times in ten seconds, is best used for eliciting vertigo and past-pointing. It is important that the head should be held in the proper position and that the chair should be made to come to a sudden stop, not gradual, if the best results are to be obtained. If one is fast enough he may make all observations after only one rotation test instead of making several to determine the nystagmus, past-pointing and vertigo after separate turnings. The latter although causing more discomfort to the patient is, however, more reliable.

In making the caloric test only one douching is required for each ear and the head is tilted back to make observations on the horizontal canal.

Chart IV is a copy of a chart used to make records of the observations.

When a patient who shows no abnormal spontaneous phenomena such as nystagmus, vertigo, past-pointing and falling is put through the tests as recorded in Chart 1 and he shows the normal reactions he is assumed not to possess any organic lesion in his inner ear or in the intracranial pathways which are interrogated by these tests.

It should here be noted that in making these tests five reactions are looked for, namely, nystagmus, vertigo, past-pointing, falling and shock (pallor, sweats, nausea and possibly vomiting).

Nystagmus is one fundamental reaction and vertigo, past-pointing and falling are grouped together as one as they more or less are dependent upon one another. Shock is a reaction of the sympathetic nervous system and may appear at any time during the tests or not until the end. Usually this is mild but frequently it is suf-

Chart IV

VESTIBULAR TESTS

Name John Doe Address Age Date

COMPLAINS OF Vertigo

HISTORY OF Dizziness Yes Staggering No Deafness No Tinnitus No

SPONTANEOUS

NYSTAGMUS
Eyes RIGHT none
Eyes LEFT none
Eyes UP none
Eyes DOWN none
Nystagmus none
Vertigo Yes
Past-pointing none
Falling none
Romberg negated
Turn head right
Turn head left
Attempt to overthrow good resistance

POINTING: RIGHT T | LEFT T

ROTATION

To RIGHT → 30° F
Amp. good
Duration 24 sec.
Nystagmus normal
Vertigo 26 sec. to left (normal)
Past-pointing normal
Head Back 60°
Head Forward

POINTING: RIGHT 12"ER | LEFT 10"ER

To LEFT ← 30° F
Amp. good
Duration 24 sec.
Nystagmus normal
Vertigo 26 sec. to right (normal)
Past-pointing normal
Head Back 60°
Head Forward

POINTING: RIGHT 12"EL | LEFT 10"EL

T. touched — to bring on the nystagmus
Dr. Rotch "

CALORIC (Water 68°F)

Douche RIGHT EAR
Amp good
After min. 45 sec.
Nystagmus normal
Vertigo to left (normal)
Past-Pointing normal
Falling to right (normal)
Head back →
Amp. good

POINTING: Right 8"ER | Left 8"ER

Douche LEFT EAR
Amp. good
After min. 45 sec.
Nystagmus normal
Vertigo to right (normal)
Past-Pointing normal
Falling to left (normal)
Head back ←
Amp. good

POINTING: Right 8"EL | Left 8"EL
Right 6"EL | Left 6"EL

FISTULA

SUMMARY Spontaneous Vertigo present
All Reactions normal

DIAGNOSIS

Vertigo due to toxic influence on inner ears - but no organic lesions present

MODIFIED FROM J. H. JONES

ficiently marked so that the balance of the tests may have to be postponed for another session.

Pathways of the Reactions

Certain nerve pathways have been assumed through which the vestibular reactions are carried. Only one has been demonstrated by Cajal histologically, the one from the external horizontal canal to the cerebellum. The others do not carry the weight of such proof. Indeed they are open to question and have been doubted by many authorities. Yet certain normal reactions take place and no one who doubts the existence of the pathways has so far offered an explanation why and how these reactions take place. The men who advocated the existence of these tracts, Jones, Fisher, Mills and Weisenberg, have recorded a number of cases bearing clinical evidence as well as autopsy findings to sustain their contention. These are recorded in a monograph, "Equilibrium and Vertigo," by Jones.

If one analyses one normal reaction an idea may be obtained of what part of the brain is probably concerned in that reaction. For example, a reaction resulting from stimulation of a horizontal canal on the right side consists of horizontal nystagmus to the left, vertigo to the left, past-pointing and falling to the right. If the inner ear is destroyed there is no such reaction and the same is true when the eighth nerve is severed. This indicates that the inner ear and eighth nerve are concerned in the reaction. A patient under an anesthetic gives a conjugate deviation and not a quick nystagmus indicating that the higher centres are also involved. A nystagmus with the slow component to the right and quick recoil to the left indicates the functioning of the nuclei of the sixth nerve (external rectus) and the third nerve (internal rectus) on both sides. These are located in the pons and the eighth nerve nuclei are located in the medulla. The existence of vertigo, falling and finally past-pointing indicates a connection with the cerebellum through the peduncles of the cerebellum and then through the spinal column to the arm through the brachial plexus to cause pointing or past-pointing. Pallor, sweats, nausea and vomiting indicate vagus and sympathetic connections.

The pathways and hypothetical lesions in their course with the resulting reactions are illustrated in Chart III.

Briefly, the pathways may be described as follows: All reactions go through the inner ear and eighth nerve. The eighth nerve carries cochlear fibres for hearing and vestibular fibres for equilibrium. The vestibular fibres come separately from the horizontal canal as one set and from the vertical canals as another set. Each set carries nystagmus fibres and vertigo fibres, (past-pointing and falling result from vertigo and come under the same group). The set from the horizontal canal enters the medulla to Deiter's nucleus and there divides. The nystagmus fibres go into the eye nuclei in the posterior longitudinal bundle and the vertigo fibres to the cerebellar nuclei through the inferior cerebellar peduncle.

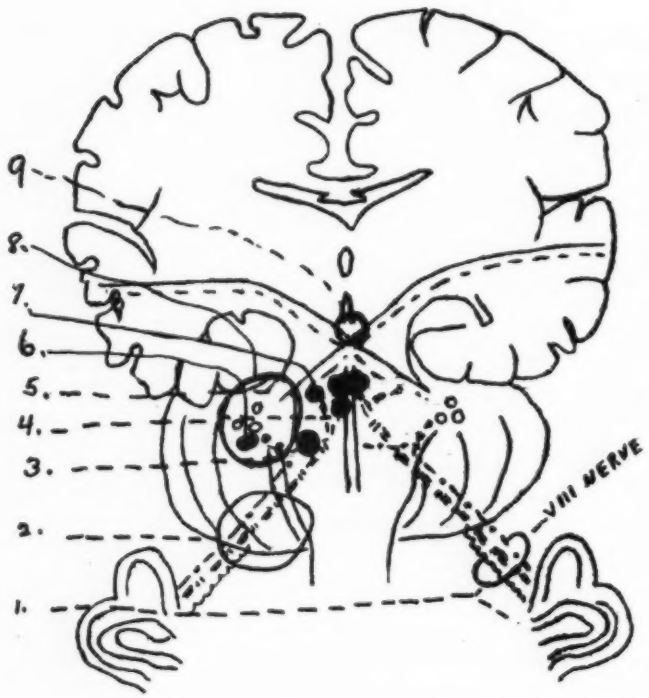
Vertical canals—The set from the vertical canals goes similarly into the medulla above Deiter's nuclei and then breaks up. The nystagmus fibres go to the eye nuclei in the posterior longitudinal bundle and the vertigo fibres go to the cerebellum by way of the middle cerebellar peduncle.

The nystagmus fibres are supposed to continue on to the cerebrum through the crura cerebri and the vertigo fibres from all canals after having entered the cerebellar nuclei cross to the opposite side of the cerebrum, first coming out of the cerebellum through the superior cerebellar peduncle.

If one examines a hypothetical lesion in Chart III an idea may be obtained of the possible reaction which may take place, should such a lesion exist. Take lesion three which is located between Deiter's nucleus and the posterior longitudinal bundle. Here the lesion is in a location on the fibres from the horizontal canal after they have split into nystagmus and

CHART III

VESTIBULAR NERVE PATHS.



Numbers in diagram point to lesions referred to in the text.

- Auditory fibres
- Nystagmus and vertigo fibres Hor. canal run to Deiter's Nuclei-Medulla
- Nystagmus fibres in Horizontal canal From Deiter's nuclei to post. long. bundle
- Vertigo fibres in Horizontal canal To cerebellar nuclei thru inf. cerebellar pedunole
- Nystagmus and vertigo fibres vertical canals to nuclei in pons above Deiter's
- Vertigo fibres vertical canals - run to cerebellum thru middle cerebellar peduncle
- Nystagmus fibres vertical canals. From pontile nuclei to eye nuclei in posterior longitudinal bundle
- From below decussation (superior cerebellar pedunole) and upward through decussation
- All fibres from vertical canals (vertigo)
- All fibres from horizontal canals (vertigo)

Hypothetical Lesions and Reactions

1. Lesion in inner ear or 8th Nerve
   NO: Nystagmus, Vertigo, Past-pointing, Falling
   YES: Deafness
   When all canals on that side are stimulated

2. Lesion in cerebello-pontile angle
   NO: Nystagmus, Vertigo, Past-pointing, Falling
   YES: Deafness
   When all canals on that side are stimulated. In addition there is impairment in vertical canals when opposite side is stimulated.

3. Lesion between Deiter's nucleus (in medulla) and posterior longitudinal bundle.
   NO: Nystagmus
   YES: Vertigo, Past-pointing, Falling
   When HORIZONTAL canal is stimulated.

4. Lesion in posterior part of pons near post. longitudinal bundle.
   NO: Nystagmus
   YES: Vertigo, Past-pointing, Falling
   When Vertical canals are stimulated.

5. Lesion in posterior longitudinal bundle
   NO: Nystagmus
   YES: Vertigo, Past-pointing, Falling
   When VERTICAL and HORIZONTAL canals are stimulated

6. Lesion in inferior cerebellar peduncle
   NO: Vertigo, Past-pointing, Falling
   YES: Nystagmus
   When HORIZONTAL canal is stimulated

7. Lesion in middle cerebellar peduncle
   NO: Vertigo, Past-pointing, Falling
   YES: Nystagmus
   When vertical canals are stimulated

8. Lesion in cerebellar nuclei
   NO: Vertigo, Past-pointing, Falling
   YES: Nystagmus
   When VERTICAL and HORIZONTAL canals of SAME side are stimulated

9. Lesion in decussation of superior cerebellar pedunoles
   NO: Vertigo, Past-pointing, Falling
   YES: Nystagmus
   When all canals of BOTH sides are stimulated.

vertigo fibres. The vertigo fibres were permitted to go on unmolested while the nystagmus fibres were intercepted. The result would be no nystagmus but vertigo, falling and past-pointing would still be present after stimulating the horizontal canal. Other lesions may similarly be assumed and their reactions foretold.

Interpretation of Abnormal Reactions

When a Bárány Test is performed and the reactions are found to be normal it is assumed that no more information can be expected from these tests as far as the patient and his ailment are concerned. It may also be assumed that the intracranial pathways through which these normal reactions take place are unimpaired. It is not to be forgotten that the pathways mentioned are not universally accepted.

When certain abnormal reactions occur certain meanings are assigned to them.

Spontaneous phenomena—In performing the tests the phenomena of nystagmus, vertigo, past-pointing and falling are looked for. These should also be looked for before any of the tests are made as they may exist spontaneously. When they are so found they have definite meanings.

Nystagmus when it has a quick and slow component is definitely of vestibular or cerebellar origin or is due to any interference with the tracts by pressure or other form of lesion. This is in contradistinction to an ocular nystagmus. The patient is asked to

roll his eyes in all directions as it is characteristic of vestibular nystagmus to become more marked when the eyes are turned in the direction of the quick component. In this way any nystagmus of mild degree can readily be detected.

Past-pointing—When it spontaneously exists may indicate a cerebellar lesion as there are centres in the cerebellum which control the pointing by the limbs. (Bárány).

Vertigo may be due to many causes and its spontaneous existence is of little help in determining its etiology except when it exists together with nystagmus. Then it is undoubtedly of vestibular origin or due to interference in the vestibular pathways.

Spontaneous falling may be due to cerebellar disease or labyrinthitis. In both instances it is accompanied by nystagmus. In labyrinthine disease it is influenced by the plane of nystagmus and is in a direction opposite to the quick component. The direction of falling will change with the change in position of the head, the latter changing the plane in which the nystagmus exists and with it the direction of the quick component. In cerebellar disease the falling is due to loss of muscular control and it is always the same muscles at fault so that the direction of falling is always in the same direction.

Resistance to overthrow—When the examiner attempts to overthrow the patient by pushing him gently in all directions the resistance offered is due to the trunk muscle contraction. These muscles are controlled by the vermis of the cerebellum so that when resistance is good the vermis is assumed to be unimpaired.

Interpretation of Abnormal Responses to Stimulation

The lesions causing the abnormal responses are classified as peripheral or central lesions. It is said to be peripheral when it is located in the internal ear. It is said to be central when it is located within the cranium.

Responses to a Peripheral Lesion

1. Impaired vestibular responses plus impaired hearing (cochlea).
2. History or presence of tinnitus.
3. Proportionate impairment of responses from horizontal and vertical canals, e.g., each impaired ½.
4. Proportionate impairment of the vertigo and nystagmus, e.g., each ⅓. If there is impairment only in the horizontal canal it suggests an involvement in that canal or its fibres in the eighth nerve or its nuclei in the brain stem. If also present in the vertical canals it suggests an end organ lesion in the inner ear as both canals are similarly involved.

It is the proportionate impairment of responses, either vertigo or nystagmus, in the vertical and horizontal canals, that suggests a peripheral lesion.

Central Lesion

1. Normal cochlea and impaired semicircular canals.
2. Normal responses from the horizontal but absent from the vertical canals and vice versa.
3. Normal nystagmus but impaired vertigo from any canal and vice versa.
4. Normal vertigo and nystagmus from any canal but impaired past-pointing in any direction of any extremity or absence of falling.
5. Spontaneous vertical nystagmus is pathognomonic of brain stem involvement by pressure or infiltration.
6. Spontaneous nystagmus to the right with non-responsive semicircular canals on the right side suggest an intra-cranial lesion. The non-responsive labyrinth if it alone were involved would produce nystagmus to the left (due to hyperactivity of the left labyrinth).
7. Spontaneous nystagmus of increasing intensity or duration is indicative of a central lesion, because a spontaneous nystagmus due to labyrinthitis is present early in the disease, becomes less marked and disappears in a few days.
8. Perverted, exaggerated and inverse nystagmus indicate brain stem involvement.
9. Stimulation of the ear giving a conjugate deviation is pathognomonic of a central lesion.
10. When there is some indication of a central lesion and the patient shows a very quick reaction of the sympathetic nervous system like shock, nausea, vomiting, pallor and sweats, the lesion is very likely supra-tentorial. When there is very little or no reaction the lesion is more likely below the tentorium.
11. A dead internal ear (vestibular and cochlear) on one side and impaired vertical canals on the opposite side suggests a cerebello-pontile angle lesion on the side of the dead labyrinth.
12. There are other such groups of reactions which have been found in different conditions which give food for thought but have not yet been shown in a sufficient number of cases to warrant their unconditional acceptance as truths.

The writer has seen two cases of temporo-sphenoidal lobe abscess which showed non-responsive vertical canals on the affected side. The horizontal canals were normal. There was also one case which showed a vertical nystagmus when the horizontal canal on one side was stimulated by douching. This was the first inkling of an intra-cranial lesion that was found in this patient which subsequently proved to be a parietal lobe and a cerebellar abscess on the side where the reaction was present. Lewis Fisher has recorded some cases of cuneus lobe abscess which showed normal vestibular reactions on the side in which the lesion is located (may show impairment of vertical canals), and non-responsive semi-circular canals on the opposite side but normal hearing on this non-responsive side. The writer has such a patient under his observation at present which so far appears to be negative for any intra-cranial lesion. Encephalogram in this case has also been negative. The patient has frontal and ethmoid sinusitis and suffers headache.

When more is known histologically about these pathways and functions of various parts of the brain much more importance will undoubtedly be attached to such group reactions.

Indications for Performing a Barany Test

Vertigo—This may be due to an intracranial lesion or to toxic irritation of the inner ear in such conditions as nephritis, gastro-intestinal disease, focal infection, sinusitis. When the Barany reactions are normal an organic intra-cranial condition may be safely eliminated as the cause of vertigo.

Headache—nystagmus—in fact any patient who shows a symptom which may be due to an intra-cranial lesion should be so tested as these tests may indicate or disprove its existence or may even localize it if the lesion is anywhere within the paths or is able to influence the pathways by pressure or infiltration.

Conclusion

These tests are of value to anyone who deals with patients who may show symptoms referable to the head.

The internist may find them helpful in eliminating intracranial cause for headache and vertigo. The neurologist would find them valuable as another means of interrogating certain parts of the brain. The ophthalmologist may find the ability to force movements of the eye muscle of value where there is a question of the existence or non-existence of an actual paralysis of any of the extra-ocular muscles. The responses to these tests are absolutely out of the voluntary control of the patient. While these tests are largely theoretical and not as exact as we would like them to be they promise a great deal in the future. The conclusion one is forced to make as a result of these tests should be taken with caution yet their performance should be encouraged as containing considerable value when more accurate experimental data shall have been accumulated.

1930 Chestnut Street.

The Rational Basis of Mental Hygiene

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New York, N. Y.

Introduction

I—Chronaxie—The Unconscious Tuner of Voluntary Activity.*
II—Oscillatory Character of Attention.
III—The Dynamism of Psychical Phenomena.
IV—Motor Externalization of Images.
V—The Fluctuations of The Affective Tone.
VI—The Organism as a Whole.
VII—The Necessity of the Technique for Conscious Adaptation.

The art of maintaining mental health, like any other hygiene, must be founded on physiological principles. In the writer's opinion, the uncertainty in the methods still prevailing keeps many a mind skeptical as to the efficacy of such an art. This is due to the fact that mental hygiene has so far been adjusted but partially to the inviolable criterion just referred to.

The overexciting conditions in modern life urge us to determine definitely the regulating mechanisms of human reactions. This is possible only by availing ourselves of all that is already known in the psychophysiological field.

The hygiene of digestion and nutrition derives its practical rules from the progressive enlightment of the laws governing the equilibrium of those functions, that is to say, of the adequate relations between the organism and the assimilable-matter medium. Thus it is necessary to apply all the psychophysiological attainments of the last sixty years to the subject of psychical adaptation to the civilized environment.

What might be called the mental sphere receives at one of its poles the transformable energy of the external world, which is returned through the opposite pole already converted into reactional response. Spanish neurology enacted thirty years ago the laws of dynamic polarization: laws of economy of space, of time and of substance in the transmission of nerve impulse (1). Across the mental sphere, however, such transformation of energy involves a series of operations which grow in complexity from the phenomena of sensation, whether perceived or not, up to that just preceding the somatic reaction. Moreover, the restriction of research exclusively to the study of voluntary reactions, in order to deduce hygienic rules of positive value, obviously appears insufficient and also responsible for the lack of precision in the prevailing methods.

II—Oscillatory Character of Attention

Let us study now the phenomena which take place at the receptive pole of the mental sphere.

If "there is nothing in intellect that was not previously in sense," it is obvious that mental health, and consequently perfect coördination in the acts of the individual's behavior, must primarily depend on the normality of sensations and on accuracy in their selection and fixation.

Some forty years ago, French psychology revealed the qualities of the function which selects and fixes certain sensations out of all those received at each moment, that is, the function of attention. The distinction that should be made between its two forms, the natural or spontaneous and the voluntary or artificial forms of attention, was then also emphasized. According to such discrimination, spontaneous attention is awakened by ordinary or habitual objects or events, and its consecutive reactions may imply either suspension or motion, but never effort. The artificial form of attention, on the contrary, should be considered as a product of civilization, developed to train us in the management of artificial stimuli, the reactions to which are always accompanied by a certain amount of effort.

Apparently continuous, the process of attention is really intermittent, and when spontaneous, rhythmical as well. Ignorance of this essential feature seems to me to be the main cause of delay in the progress of human adaptation to the civilized environment.

In any of its forms, attention operates as a momentary interruption of that "perpetual sway of internal phenomena — sensations — feelings — ideas — images—which constitutes the basic mechanism of ordinary mental life" (9). It must be added that those acts of interruption are always accomplished by muscles and through muscles, thus having an essentially *motor* character. In the case of spontaneous attention we find it to oscillate with the same regularity as that of the general mass of sensations, although in an opposite direction to bring about the selection of sensations originated in ordinary stimuli. Then any appreciable modification in the length of the intervals of the oscillation of attention is not required.

Spontaneous attention and subconscious rhythm are therefore isochronous; their oscillations may be graphically represented by a sinusoid (Fig. 4.). Periods of activity alternate with intervals of rest during which the energy used during the former is regained. One conceives that the coördination and the physiological intensity of muscular responses will primarily depend on the regularity and extent of the intervals of rest. Normal functioning will be maintained as long as the rhythm persists. The most out-

* This, the first article of the series, appeared in the Medical Times of March, 1930, as part of the October, 1929, program of the New York Electrotherapeutic Society, now the New York Physical Therapy Society.

standing proof of such rhythmicity is the act of walking. We usually do this unaware of the regularity in the alternative use of one or the other limb for our individual transportation.

It is easy to realize that the mechanism of voluntary attention should consist in the greater or lesser elongation of the active phases of mental selection at the expense of those of rest. Also, for each case and at each moment of attention the invasion of the negative phase B C by the positive phase A B (Fig. 5) is done to a different degree depending on the interest aroused by the strangeness or novelty of the object or event which are the qualities demanding the artificial form of attention.

It may also be assumed that the reductions in the intervals of rest just referred to are harmless only within certain limits. For instance, between *n" a"* (Fig. 5). Otherwise the function may be disturbed, especially when the said intervals of rest tend to disappear entirely. In such case the curve of voluntary attention will more or less depart from the sinusoidal regularity. Corresponding degrees of muscular spasm will then follow.

One may conceive now the number of occasions met both, by children in schools and adults in every day life, when they extend excessively the active phase of attention to see new objects or events under unfavorable conditions of modern life.

This point deserves closer study. The spaces n' a', n" a" (Fig. 5) have been represented by straight line segments for didactic reasons. I hasten to point out, however, that such graphic representation is not correct if accepted as final to emphasize the fact that the positive phases invade the negative ones. Undoubtedly straight lines are the usual means to represent continuity, but in the present case, far from admitting as continuous the elongation of the active periods during which attention becomes artificial or voluntary, one feels inclined to imagine such elongations as a phenomenon of the same oscillatory character as that of the spontaneous attention though of a considerably higher rate. In other words, as sets of vibrations with very much shorter wave length (Fig. 6). The number of vibrations of each set must vary according to the corresponding length of the part of negative phase invaded, that is, to the changing duration of periods of artificial attention.

The apparent continuity of attention originates in the fact that at all moments the sets of vibrations dealt with are not alike, though individually rhythmical, and associate to the active phases of the spontaneous rhythm. The commotion resulting at each moment of integration of both kinds of oscillations should not obviously be represented by a more or less long straight line segment, which would be absurd, but by a curve of a peculiar form, resulting from the algebraic addition of its two components, that is, the short and the long wave length. Such a curve, maintained by the relative proportion of those two elements, might be compared to the one representing in acoustics the quality of *timbre*. Every one knows that this quality does not depend, like tonality, on the number of vibrations nor on the latter's amplitude, like intensity, but on the harmonics or vibrations of different wave lengths, which always accompany the fundamental note (Fig. 7).

Now it is not difficult to understand the appearance of continuous irregularity of a process in which the duration, the amplitude and the form of its phases can be so variable that the number of their possible combinations is beyond calculation. I will not endeavor the impossible task of giving graphic expression of such a variability. Notwithstanding, it will be easy to offer in a brief manner some demonstration that attention, in its two forms, is really of an oscillatory nature.

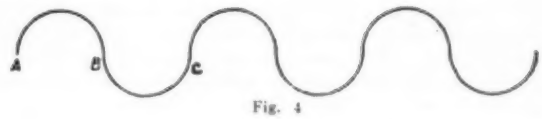

Fig. 4

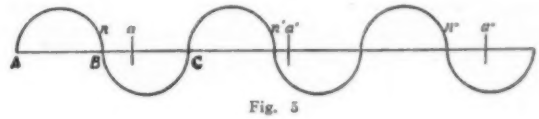

Fig. 5

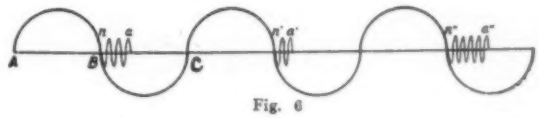

Fig. 6

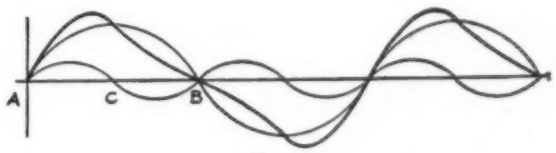

Fig. 7
From A. Broca (Physique Medicale, Paris, 1907)

Fig. 8
Melodic Swing

A subjective proof may be obtained by any one as regards its spontaneous form. If a subject with normal sight looks at a transparent many-looped lighted electric bulb located at a distance, at first it will appear to him as a mass of light. If the subject establishes and maintains a pendulum-like motion of his gaze from one side to the opposite of the bulb's light area, he will find that the loops gradually become clearer and more distinct, until they are finally perceived with a sharpness never before known to him even at much shorter distances. Thus the image of each loop appears so independent from the other as to permit the perfect vision of their shapes which previously appeared indistinct.

In the experiment the correction of the bulb's primary image has been brought about by eliminating the erroneous elements which existed only in the subject's mind, as they vanished by virtue of an efficacious means of correct perception, that is, the voluntary visual swing of the observer.

A few years ago, under the denomination of *melodic swing*, I proposed the above demonstration through the auditory instead of the visual sense (10). It consists in the repeated silent evocation of an easy musical phrase, changed alternatively one octave (Fig. 8). During this mental exercise an involuntary ocular swing of a short amplitude is inevitably produced. If the subject is looking simultaneously at the electric bulb, his perception of the loops will become as clear and definite as when he performed the voluntary visual swing previously described. The

improvement in perception will be in direct proportion to the exactness and clearness of the evocation of each note of the phrase and also of the alternative change in the octave. In the experiment the notes represent sets of rapid vibrations corresponding to moments of the voluntary attention necessary to give each note its own value; while the ups and downs of the octaves follow the slower and easier rhythm of subconscious attention.

The alternating succession of these two rhythms in the way that I have just shown, that is, with no intermingling whatever of the two kinds of oscillations—the shorter and the longer wave length—furnishes the best means to obtain perfect perception. For it limits and also makes equal the spaces *n-a, n' a'*, etc., (Fig. 5 & 6), without disturbing the normal rhythm of subconscious attention. That irregular variability in ordinary life that I referred to when dealing with the fusion of the active periods of both forms of attention, entirely disappears during the performance of this exercise, thus making evident the hidden mechanism of accurate perception. While the subconscious swing has been kept invariable by the artificial equalization of the sets of voluntary attention, any observer can estimate the normal rate of the spontaneous rhythm: I have found it to be from 36 to 40 oscillations per minute, although in the past it had been spoken of rather indefinitely. It may be observed that this figure is half of the heart rate and double the respiratory rate.

By means of a mechanical device, elsewhere described, (10 & 3) I have arrived at an experimental demonstration of the vibratory character of voluntary attention (Fig. 9 & 10). A rhythmical shifting in the observer's sight is unconsciously produced by it. This is fast enough to give him the illusion of continuous perception of objects really seen interruptedly. If the speed of the machine is slow, the vision of the object, as for example that of a transparent lighted electric bulb, does not appear continuous. But if the speed is gradually increased, at 1600 revolutions, the subject has the illusion that the object is seen continuously, although, in reality, this is not true. Coincidentally, the details of the object are perfectly perceived. A simple calculation shows that the longest fraction of time necessary for the successive visual impressions to come so close as to produce the illusion of continuous perception is about 1/60 of a second. This fraction, 0"018, might therefore be called a *third* of time. Above that quotient the interval between two successive visual sensations begins to be large enough to permit them to be appreciated independently.

I wish to recall now that the six notes in the melodic swing which fill the moment of conscious attention, must be mentally sung only as quickly as it is necessary for their clearest individual evocation and require that the change in the octave, in its turn, be made with the lowest speed necessary to maintain the optimum rate of subconscious attention. Thus one realizes that the best perception always depends on the perfect adjustment of sensations to their respective specific intervals. Numberless series of these manifold *elementary units of physiological time* measure the lapses during which the corresponding events of our daily life occur in their endless variety.

Hence the second conclusion:

Attention works on muscles and through muscles. Spontaneous attention requires no effort whatsoever. On the contrary the unconscious exaggeration of the active phases of voluntary attention often causes muscular strain. The relatively slow rhythm of spontaneous attention can be established at will through any of the higher senses, with real benefit to perception and to the proper control of voluntary attention.

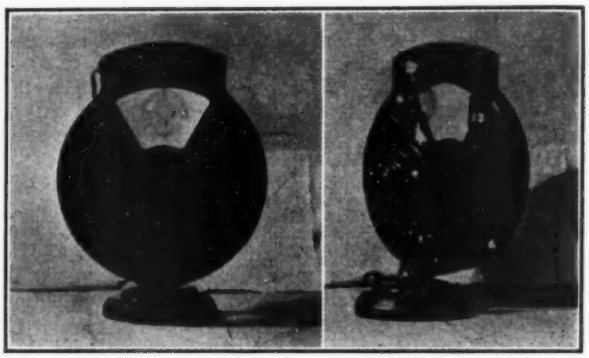

Fig. 9 Fig. 10

THE TACHORTHORCOPE

III—The Dynamism of Psychical Phenomena

The third rational basis of mental hygiene that I wish to deal with now is entirely psychological. It is derived from the study of phenomena which do not develop at the poles, but rather within the mental sphere itself.

At the end of the last century the dynamic power of sensation was experimentally demonstrated (11). Wherever sensation takes place and specially when it passes over the threshold of perception, sensation raises the potential of the preexisting nerve energy, which is then distributed in three different discharges (Fig. 11). The first discharge is purely representative or intellectual and transmits itself through the associative paths in order to share in the performance of highly psychical operations. The second discharge is motor, the third affective.

Let us now study the first.

Two kinds of elements participate in every act of perception; the sensations actually provoked by the object and the past sensations or remembrances that memory adds for the interpretation of the object as it really is and not as it deceitfully might appear. But these mnesic elements were actual sensations themselves at the time of their coming into existence and have therefore a similar vibratory character when reinstated by memory as movements or *motor habits* and not as static, stereotyped slides.

By combining mnesic elements imagination on its part creates new representations with no real existence in the external world. A centaur, for instance, exists nowhere, but the successive evocation of a human being and a quadruped furnishes the components of such a myth. It is easy to demonstrate by introspection that the more the details of the object are imagined successively or the better the oscillation between them is maintained, the clearer the object's representation will be, thus revealing the intrinsically oscillatory nature of the phenomenon of imagination.

While a subject looks at the bulb of the previous experiment, (Part II), he is asked to keep his mind busy by remembering any familiar object perfectly. After a few minutes he will observe that his perception of the loops is as perfect as it was when he kept

up the voluntary swing or when the tachorthoscope was employed. In the same manner, if he imagines something of his own creation perfectly while looking at the bulb, he will have almost immediately a perfect perception of the loops. The identical results in both cases are undoubtedly due to the fact that it is impossible to keep on remembering exactly any known object or to imagine any new one clearly without evoking either successively or in an oscillatory manner their different parts. If we try the opposite, that is, the evocation or the creation of the object in toto or as a complete entity, one of two things will then be observed. Either the perfect vision of the loops will be only fleeting, unless repeated evocation of the object is performed with a certain frequency, or the appreciation of the details in the illuminated area will continue blurred.

One is inclined to assume that the higher the degree in complication of mental operations the higher the vibration rates must be, as the representations are built up on more or less complicated combinations of sensations constantly reinstated in consciousness.

The intellectual mechanism of *comparison* implies the swing of ideas or images from one to the other. That of *association* on the other hand implies the attraction of ideas to a main central one predominating at a given moment and elimination of others that are secondary. In fact two ideas or images can not be fixed simultaneously and "this natural tendency to an overwhelming monoideism constitutes the very essence of attention" (9). In other words, the whole mechanism would essentially consist of a constantly shifting central fixation in the mind.

"The ordinary idea is not a simple element of consciousness, but a complex of many centrally aroused sensations. . . . If one asks why an idea recalls the one that accompanied or succeeded it, one must be referred to the study of the nervous system. In its terms one law is that if two neurons are active simultaneously or in immediate succession, some connection is established of such a character that if one be excited in any way the excitation spreads to the other. The point of connection is the synapse. . . . The change in the synapse as a result of use is the explanation of association, as of habit. Association by continuity and succession is the expression of this simple and familiar neurological function. . . . For thought, the idea is the unit; one is concerned only with things and with their representations as wholes. Association, on the contrary, is always between the elements that correspond to the activity of neurons. Their connections alone determine the way in which ideas shall succeed each other and how they shall dissolve, one into the other. The older laws of association considered only the relation between the ideas as wholes; any dynamic explanation must consider primarily the connections between the elements. They explained by simultaneity what the more modern men explain by the shifting of associates about some persisting element as a core. Both are true but one is a description of the ideas after the recall, the other is the real explanation of the recall. . . . The selection of one from among the possible associates has approximately the same conditions as the selection of sensations in attention. . . . Only one associate can be physiologically strongest at one moment" (12).

If any dynamic explanation of mental association must consider primarily the connections between the elements, it is only opportune to remember again that "any anatomical element, any kind of cell, reckons time according to a particular standard, say thousandths or perhaps hundredths of a second" (2). "In a given neuron—says the discoverer of chronaxie—nervous impulses on the one hand and the excitability on the other are governed by this particular

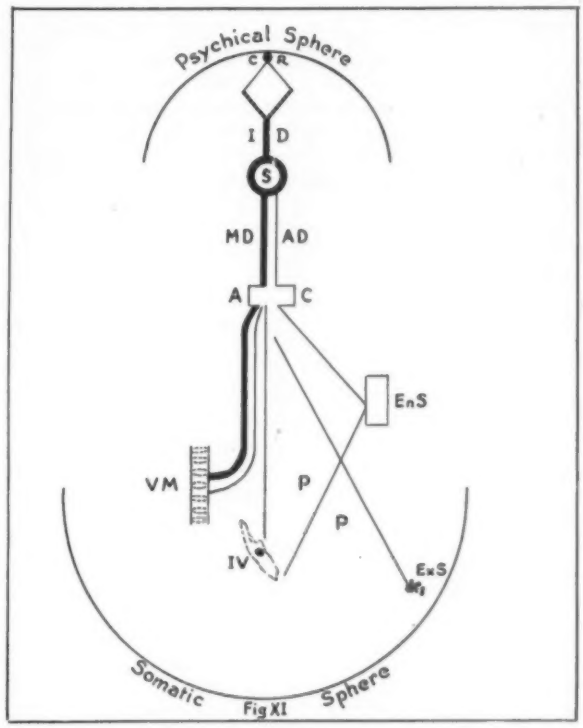

Figure XI
CR—Center of the mental representation
S—Sensation
ID—Intellectual discharge
MD—Motor discharge
AD—Affective discharge
AC—Axial centres
VM—Voluntary muscle
IM—Involuntary muscle
ES—Endocrine System
P—Plasma
ExS—Exocrine System.

time standard. The impulse coming from one neuron to another can only stimulate the second one if the temporal characteristics of both are equal or nearly so. In other words, excitation will pass easily if neurons in anatomical connections are isochronous, but will not pass at all if the neurons are heterochronous. As a matter of fact, the motor impulse of a peripheral nerve will no longer activate the striated muscle it controls if either the nerve or the muscle has been poisoned so as to definitely change its natural time factor" (2).

Abstraction makes possible the formation of groups of concrete representations in which certain elements are reinforced while others are weakened. "The same causes modifying the duration of the active phases of attention work also upon abstraction, which, like attention, may be instinctive, spontaneous, natural, or else reflective, voluntary, artificial. In the former case, the act of abstraction results from any attractive quality of the object and constitutes the ordinary demonstration of intellectual life. In the second form, rarer and phylogenetically higher, abstraction originates less from the attractive qualities of the object than from the subject's will and presupposes a more precise selection of certain elements with a

more laborious elimination of others, in order to attain the difficult task of maintaining the product of abstraction sufficiently clear in consciousness. Abstraction therefore becomes a special application of attention" (9). Images, after all, irrespective of their origin, be it perception, memory or imagination, are but products of abstraction from sensations. They constitute a true mental synthesis, wherein form, which is rhythm in space, and rhythm, which is form in time, are the ever persisting intensified elements. Both, form, which is related to spatial, geometrical conceptions, and rhythm, which is adjusted to intervals of time, are as inseparable from each other as space and time in the new, unitary conception of the physical universe. Such integration, constantly repeated in the mind, represents the individual's adaptation to the coincidental world events, as a specific mechanism for the preservation of normal equilibrium in his conscious life.

As may be seen, from sensation up to the most complicated psychical operations, the phenomenon of oscillation proves constant. From the subconscious monorhythm up to the abstraction of the genius, the hierarchy in mind functions seems to depend on laws of vibratory rate, of associative and synthetic power, of agility in the changes of energetic tension.

No doubt that is the reason why it has been said that "contemporary psychology unanimously recognizes that the entire mind activity is but a prodigiously complicated modality of motion" (13). In fact, the natural mechanism of the mind might be summed up as a more or less prolonged interruption of the subconscious rhythm in order to acquire, by acts of attention, clear representations of objects and of their relative positions and possible movements; in one word, of external world variations. These representations are the substratum of memory and of still higher functions. The acts of attention, that is, of fixation, to repeat it once more, must always be successive, never simultaneous or directed on more than one point at a time, and of more or less short duration, according to the case. To state it in another manner, mental activity requires a more or less frequent departure from a uniformly rhythmical state, which is its natural way of resting* in order to fix for a brief instant an idea or image, then to rest, again to come to the same or other act of representation, and so forth.

Man possesses this attribute which radically distinguishes him from the animal; it is the power of the conception of Time and its utilization in behalf of generations to follow, thus preparing the future on the experience of the past. Psychology of all times establishes that there is no consciousness of the present without memory and that imagination, a special human characterstic, can not be without it either. For in the absence of imagination, all other high mental processes are obviously impossible. "To know, is to appreciate similarity and difference" (Bain). Who could have then established the similarities and differences without previously swinging the attention from the new object to a like one or to an unlike one already known; or without an analytical shifting on the various parts of the new object? The serious aspect of the problem is the continuous variability of the fixation periods, which in its turn depends on the incalculable degrees of interest the strangeness or novelty of the object may arouse. Consequently, on the economic preservation of the intervals between the active phases of attention will the mind's sound activity primarily depend.

General physics, on the other hand, points out as the invariable chronological unit the minute interval between the most elementary events in the physical world, namely, the intervals between two "moments" of light propagation in the space—time continuity. This last notion shares in the establisment of the following postulate:

The invariability in the intervals between the elementary events of the external world keeps them uniformly rhythmical. Our high psychism, on the contrary, has, as an essential feature, the power of modifying the intervals between its internal changes, in order to know, through proper adaptation, the constantly varying non-elementary events of the external world. Besides events, objects also must be included, since Matter is now considered but another form of energy.

IV—Motor Externalization of Images

Let us look again at the emissary pole of the mental sphere.

If obedience of voluntary contractions to the law of chronaxic harmony was something unknown until only a short time ago, rhythmicity in the motor acts of the vegetative system was always taken as evident. In the last eighty years, however, the notion of the existence of another type of involuntary motor waves has developed. These waves which arise synchronously with psychical representations make effective the latters' tendency to external projection.

It is admitted to-day that "every mental picture irrespective of its origin tends to a motor externalization, whether direct or deviated" (13, page 77). From this may be inferred that whenever an image—for instance, of perception—is perfectly formed the centrifugal impulses accompanying it are transmitted directly, i.e., through proper paths, to those contractile fibres which normally prepare the respective sense-organ for the exact reception of subsequent impressions. If, on the contrary, the mental picture is blurred or imperfect, say, if it is not focussed on that particular point that might be called "centre of mental representation", its motor energy will deviate from the ordinary channels to a greater or lesser degree. In the second case two different things may happen: either the impulses will stimulate the normal fibres, though causing in them a state of discordance, or the impulses will arouse contractions in other fibres which may be more or less alien or far away from the respective sensorial apparatus. In both instances the result will be the same: trouble in the muscular contractions as a consequence of an abnormal stimulation.

It is very simple to obtain the subjective evidence of that ideomotor correlation. Eyes closed, the subject thinks, for example, of a see-saw in motion. If he imagines the oscillatory movement correctly, the subject will soon notice that coordinated movements of his eyeballs obediently follow those of his mind. Alternation of active and rest periods is a feature as common to these two functions—vision and imagination—as to all others. The latter nourishes itself from sources of activity furnished by the former during wakefulness. The eyes in their turn unconsciously follow the constant shifting of the mind in order to make possible perfect central fixation at each moment of these two functions.

* "Rest is not quitting the busy career,
Rest is the fitting of self to its sphere."—*Goethe.*

Although less easy to be detected in all other functions, the mechanism just dealt with is a general one, as we shall soon see. For that reason, undoubtedly, it has been said that "the motor Unconscious is what forms the frame work of the whole psychical make-up" (13, page 83).

When describing the experiment with the lighted bulb (Part 11) I pointed out the improvement obtained in the visual perception of its loops by the evocation of a rhythm. I must add now that an identical improvement results in case of any object whether luminous or not; the only difference is that in the latter case the conscious performance—oscillations or repeated evocations—requires longer duration, for then one is not dealing with a glittering object. In the instance of the lighted bulb, the appreciation of the image's correcting process is greatly helped by the very luminosity of the erroneous elements of perception, which yield more readily to the correcting mechanism. The involuntary motor discharge accompanying the act of representation is therefore channeled and coördinated by the very agencies which form or reproduce the images. Both the foregoing factor and memory, namely, consciousness of the past and imagination, which prepares the future, cooperate in the interpretation of the present, i.e. in the fleeting moment of actual perception.

On the other hand, it is admitted that "every voluntary movement is the exact performance of a mental project" (14). From this and from the foregoing, I deem justified in formulating a fourth basic conclusion as follows:

Every mental representation, irrespective of its origin, whether perception, memory or imagination, tends to a motor externalization. When images are perfect, with their motor reactions running through proper channels, they stimulate the muscle fibres to a normal degree. If, on the contrary, the mental pictures are blurred or imperfect, their motor impulses deviate and may cause abnormal muscular contractions.

V—The Fluctuations of the Affective Tone

It is no longer pure lyricism to speak of "affective vibrations". Latest psychology admits that "the most complicated facts of clear thinking are but syntheses or condensations of the elementary biological facts of the sensorial impressions—emotions, motor tendency—which consist of undulatory movements". At close sight not only emotional phenomena but all the psychical ones—attention, flux of our habitual thoughts, etc., are rhythmical" (13, pages 39, 40).

In their propagation towards the organs, the affective waves intimately accompany the changes of the excitomotor potential in the vegetative nervous system, although not totally. At certain levels of the central nervous system the emotional discharge bifurcates: one part goes to the organs associated with the fluctuations in the general vago-sympathetic tension; the other part deviates towards the endocrine glands to stimulate the output of specific metabolites necessary for humoral regulation (Fig. 11).

Well known anatomical arrangements explain that, despite such partial deviation of the affective discharge, its final synchronism with the motor one at the periphery is not disturbed in ordinary conditions. Synchronism is assured there as exactly as it was at the very moment of its central start, because of the arrival in time of the humoral share in the adequate organic reaction. For instance, "the neurons of the great splanchnic system have no synapses at the level of the chain ganglia, but they extend directly from the *tractus intermedio-lateralis* down to the adrenals" (15). In that manner, the time apparently lost by the deviation referred to is compensated by that gained by the impulse while traveling without interruption towards the adrenals, which by means of adrenalin contribute to the maintainance of muscular tone (Fig. 11).

Since the end of the World War, the interpretation of certain psychoneurotic syndromes as exclusively caused by emotion, and the increasing recognition of the importance of this factor in such other condition as glaucoma, have encouraged lately the study of the humoral disturbances brought about by emotional shocks. All these disturbances seem to be, in the final analysis, of a purely physical nature; as are the changes in the superficial tension, the refractometric index, the viscosity, the ionic dissociation and the colloidal equilibrium of the serum. When intense, they constitute what has been called psychoclassic shock", namely, "the result of a sudden change in the conditions of adaptation of the affective tone of tendencies" (15).

The slight emotive waves accompanying the perception of things and events in ordinary life do not cause any trouble whatsoever. They are syntonic with the other two discharges, the intellectual or representative and the motor; their propagation is made through the usual *homochronic* channels. They are, thus, the adequate stimulus of the natural affective tone. This tone, derived from the metabolic processes, is maintained by the continuous stream of the cœnesthetic, physiologically unperceived, impressions. The syntonism of the three discharges is then assured as an essential requirement of the affective equilibrium; but when by the intensity, the suddenness or the frequent repetition of the emotional agent the affective tide trespasses its ordinary limit, its associated motor tone rises in proportion, so as to overexcite the muscular fibres in charge of the general emotive reaction. In order to obtain proper adaptation, the endocrine assistance should then also be increased, with the consequent strain of this regulating system. The peripheral synchronism will thus be in danger of disturbance, hence the possibility of humoral imbalance and at the same time of that of the motor tension.

It must be remembered that in vegetative functions their characteristic periodicity requires an automatic, self maintained mechanism. Blood represents at each moment the chemical synthesis of the organism whose continuation of life is not possible without keeping up a determined degree of alkalinity. It is a proven fact that the range of oscillation of what is termed "acid-basic equilibrium", or pH of the blood, which is extremely restricted normally, becomes exaggerated at the occasions of strong or too frequently repeated emotions. When normal, such oscillation might be called "fundamental rhythm of vegetative life". To this rhythm the regular variations in acidity or alkalinity taking place in the different parts of the digestive tract should subordinate, as well as the motor reactions of this apparatus, which also must be successively accomplished in regular periods of time.

It has recently been demonstrated that "the substances resulting from the work of the vegetative system contained in the blood represent the natural stimuli of the sympathetic and the parasympathetic terminal fibres"; that "the functional equilibrium of the organs is maintained only when the blood stream has a normal amphotropism; that is to say, when the

sympathicotropic and parasympathicotropic substances sustain the proper degree of absolute tonus in the vegetative terminal fibres". . . Any change in the normal amphotropism of the circulating medium brings about an alteration in the absolute vegetative tone which causes general hyper or hypotonias" (16).

All the above is easy to understand. In final analysis, the nervous potential is used through elements which, if analogous in nature, are antagonistic by their anatomical dispositions. These elements are smooth muscle fibres; their normal responses will maintain physiological balance between both subdivisions of the vegetative nervous system. If, on the contrary, those fibres are overstimulated, their fatigue will prevent the natural consumption of the nervous energy alloted to them and, consequently, a state of retrograde hypertension in their innervating fibres will necessarily occur. It must not be forgotten that quantity, quality and periodicity of the natural stimuli of the system—especially food—are factors which may often be inadequate.

On the other hand, no one ignores the lowering in sensorial acuity caused by emotions. The representative discharge, like the other two, also shares the effects of the general conmotion. The sensitization of memory, often durable, becomes a reiterating agent of emotional disturbances and may constitute what is known as "sentiment-emotion". The result of this persisting influence is the awakening, with more or less intensity, of the original disturbing element at each evocation.

What is usually overlooked, however, is the fact that the slight but continuous emotions of daily life, caused by the perception of unfamiliar objects or new events under unfavorable conditions, bring about a certain degree of muscular hypertonism, which itself is the effect of the neuromotor hypertension induced by the affective discharge. In each individual certain muscular groups are more prone to respond to that almost continuous overstimulation; a more or less systematized spasmodic or contractural condition frequently results, which is wrongly attributed to causes other than the really psychogenic one. Schools, factories, offices, etc., are extensive fields in which to observe such conditions. For instance, take notice from a teacher's desk of the unnecessary gestures and peculiar head postures with which the pupils accompany their attention to the blackboard, maps, diagrams and so forth. Even in those individuals with practically normal vision it is easy to realize that the ocular muscles are not the only ones under the psychical strain I have referred to. Numberless shortcomings or maladjustments and minor departures enter into these cases (3). Patients are thoroughly unaware that their discomforts or their deficiencies are originally due to the almost constant fluctuation of their insufficiently regulated affectivity. The daily accumulation of such an excess of nervous potential undoubtedly favors and explains the appearance of functional disturbances of accessional character at the addition of even more intense or sudden emotions. Attacks of asthma, of sick headaches, of insomnia and of certain other neuroses, which could not be pathogenically explained otherwise, are clinical facts actually considered as psychogenic manifestations. These vanish as soon as their true cause—the unconscious mind strain of affective origin—yields to proper psychotherapy.

As to the effects of emotions on the representative discharge, they certainly do not confine themselves to a momentary lowering in the exact fixation of actual sensations. The faithfulness of memory, the agility of imagination, which must cooperate in the acts of perception, are harmed also in many individuals, in whom a tendency is then aroused to compensate, through unconscious elongation of the active phases of voluntary attention, the deficit in adjustment for synchronism of the two elements of perception. A certain degree of mental laziness usually persists in them as sequelae. This satisfactorily explains the reluctance of some of these subjects to perform the reeducational exercises of conscious self regulation.

Summing up, allow me to add this fifth base:

The basal affective tone which springs from metabolism and is regulated by the endocrine system fluctuates within certain normal limits by virtue of the emotive discharges of ordinary perceptions and representations. The dystonia produced by extraordinary perceptions and representations, varying with the intensity, the strangeness and the suddenness of the emotional stimulus, disturbs more or less deeply the distribution of the other two discharges—the representative and the motor—and overworks the mechanism of humoral regulation.

VI—The Organism as a Whole

Inasmuch as voluntary motor coordination and vegetative equilibrium are each bound to the same law of rhythmicity, all leads to the conclusion that a higher rhythm presides in turn over the mutual correlation of both spheres—the vegetative and voluntary—in order to assure the same tendency to unit which characterizes psychical activity in their reactions.

How can that reactional integration be understood?

Contemporary psychology is defined as "the study of the tendencies of the whole individual as expressed in the psyche, the function of the individual, in distinction from physiology, which deals only with the functions of the several parts, the organs" (17). If, on the other hand, the main rôle of the higher psychism seems to be to repress or moderate wishes so as to adjust them to the progressive betterment of life in common, why should one be surprised at the fact that mankind, in its present degree of civilization, is concerned more than ever with the study of the regulating mechanism of psychical functions?

As in other physiological problems, pathology and clinical medicine throw a light that is impossible to attain by direct ways of experimental research. The study of lethargic encephalitis, for instance, is exceptionally fruitful for the induction of the normal functioning of the regulating centres of mental activity.

"The cerebral cortex is a perfecting organ of inappreciable value, a marvelous organ of storage which represents an instrument for progress almost unlimited for those beings like man who are fortunate enough to possess it. But in many animals there exist psychical functions without cortical substance, and the subcortical centers, more ancient and more resistant, have under their control the functions of the cortex which in the animal evolution appears later. The subcortical centres are in relation with the rudimentary psychism, which perfects itself through the development of the cortex, and give to the functions of the cortex when it appears their activity, their rhythm, their tonality and even their personality, it might be said. The states of euphoria, of depression, of joy and of sorrow depend upon these centres, which are necessary for the externalization of such states as laughter, crying, speech, modulation, gesticulation, etc. It is by means of tied connections with them that cortical images, memory associations, in fact all cortical functions, externalize themselves by adapted

manifestations. Subcortical centres share also in the fixation and evocation of elements of memory by means of their connections with the cortex on the one hand and with the vasomotor, secretory, motor, cœnesthetic centres on the other, all of which play an important part in emotions provoked or evoked" (18).

All these centres are reciprocally acted upon by the cortical ones and both kinds of centres are controlled in turn by the so-called "higher centres."

"I imagine these higher centres more precisely than it is usually done. I make an effort to localize them in the very centre of the central consciousness and consider them as the container of all sensitive—sensorial sensations, in the broadest meaning of the word, and also of the entire psychical activity. It is there whence the will and voluntary gesticulation emanate. Through it must pass all forms of voluntary reactions, be it a movement, a sentiment, an idea, or a word. I do not seek that supreme centre in the cortex, which is a young and bilateral formation, but in a tractus site uniting both hemispheres in the neighborhood of the autonomic sensory and vegetative centre. Any commotion affecting it may bring about hysteria, epilepsy, psychosis and many morbid phenomena in the vegetative realm. It is by its injury that I realize the facts of somnambulism, of hypnosis, and in some way the abnormal automatism of the subcortical centres in the various diseases. I would believe that it is in that particular centre where the hereditary characters and the germinative substance are kept, and where all psychic reality concentrates itself. This centre is superposed to all the autonomic subcortical ones, over which it normally works through the cortex, by regulating and controlling every motor act" (19).

These up-to-date hypotheses regarding the existence and the reciprocal actions of psychosomatic centres of regulation find their verification when applied to that organic apparatus in which functional harmony may be less difficult than in any other for analytical study, from both anatomical and physiological viewpoints. I refer to the visual apparatus.

On the afferent part of the visual apparatus at least four pairs of images of any contemplated object are formed. The first pair is formed at the retinal foveas; the second in the optical primary centers of the midbrain; the third in the neighborhood of the calcarine fissure, properly called "cortical retinas"; the fourth in the center of mental representation where despite the multiplicity of the images reaching it, the individual perceives the object as one instead of two. The clearness of the resulting image, that is, the accuracy of perception, requires that perfectly synergic efferent acts adjusted at each moment of vision be performed by all the motor elements of the apparatus, in order to adapt the latter to the conditions of distance, size and degree of illumination of the object seen. In these motor responses to afferent stimuli neuromuscular factors, both vegetative and cerebrospinal, take part simultaneously. Their anatomical and functional independence in the particular department I am now dealing with, appear clear enough to utilize their mechanism for general physiological inductions. I have discussed these points in a previous work (3).

Although less easy to detect in other functions that coordinating mechanism is no less certain in all others. But just as we make a distinction between the simply spontaneous and the entirely deliberated acts of our behavior, it is obvious that out of the automatic ones two different groups can be formed: one in which automatism is absolute and continuous, as for instance in circulation, digestion, etc.; another where acts may become conscious and temporarily obedient to will within certain limits, as respiration, mastication, walking, etc. The reciprocal influence between these two controls, the voluntary and the automatic, can not be well understood without admitting the existence, probably in the centre of consciousness, as quoted above, of a supreme mechanism of regulation dominating both of them.

The reality of such a supreme direction is shown in the fundamental rhythm synchronous with spontaneous attention, to which all other rhythms, psychical and somatic as well, should subordinate as harmonics of incalculable variety, at each instance of the general organic concert. The irregularity or the excessive retardation of the subconscious rhythm is revealed either by the abnormal predominance of the automatic centres, with the consequent production of spasm or contracture, or simply by a more or less intense, scattered muscular fatigue.

On the other hand, clinical experience has shown that through keen evocation of that rhythm or of images, it is possible to maintain the former's regularity and also to reestablish it when for any cause it may be disturbed. The inward pendulum-like motion seems to represent the individual's energy from the time of his conception until his last breath, as a dynamic synthesis of his reactional unity.

One may realize that the efferent impulses induced by memory and fantasy-images may act upon this supreme regulating center when they arrive there, in either of two ways; first, if images are perfect, their motor reactions will keep the regulating rhythm normal; second, if on the contrary, the mental pictures are blurred or imperfect, their motor impulses, by disturbing the frequency or the regularity of that rhythm, may cause somatic troubles. Perfection in perception and exactness in reactional coordination are indissolubly connected with normal regularity and frequency of the subconscious rhythm.

Now then, if our second hygienic base is remembered, there will be no difficulty in admitting its strict solidarity with the present one, which may be formulated as follows:

The general harmony in the reactions of the individual as a whole to any stimulus is controlled by his subconscious rhythm. The frequent voluntary exercise of memory and imagination, in accordance with the laws of their mechanism, is the rational means to maintain normality in the supreme regulating rhythm as well as to prevent the effects of affective dystonia.

VII—The Necessity of the Technique for Conscious Adaptation

No one fails to recognize that nowadays the opportunities to advise "not to worry" are more numerous than ever before. After all, that advice was always more difficult to follow than to give. Life, in fact, becomes again and again more complex, especially in the large communities. Is this for the sake of Industry? Surely. For the benefit of the public at large? Perhaps. But at any rate it is undoubtedly for the individual's harm or detriment, both physical and mental.

Artificial objects, sudden events, difficult situations, all grow in number every day. They lash our senses, our affectivity, our motor mechanisms; and above all these overexciting factors, there is one—haste—which prevails and increases the complexity of modern life. Hurry for everything, no matter how insignificant, is something that imitation imposes, and association develops. Hence an excess of attention paid to details which may be essentially worthless, but which, if overestimated and repeated, origi-

nate conditions of unconscious mind strain frequently attributed to other causes.

"The overexciting emotions of modern life and the strain derived from them create conditions most favorable for the development of nervous disturbances. The psychopaths must not be sought in the Asylums. They are everywhere and we meet them daily, or see them going from the physician's office to the hospital clinics. In fact almost everybody is more or less unbalanced and consequently there is an ever increasing proportion of criminality, especially among children" (20).

Information of this sort comes from everywhere. Everybody seems to agree as regards the importance of this problem and of the urgency for a solution. Every one misses the clearness and the precision in the hygienic rules that the psychophysiological advancements should constantly furnish. Unfortunately the search for a remedy is very often directed towards the effects of the evil instead of towards its cause, although the effects, no matter how numerous or proteiform, can be reduced to a common origin, e.i., the misuse of psychical energy.

Let us remember moreover that besides the purely psychogenic disturbances it is necessary to consider the important group of the psychical and vegetative ones that are connected with organic processes of varied etiology, the general mechanism of which is but the muscular spasm, especially that of the blood vessels, added to the specific cause. For if it is true that "everyone is as old as his arteries", the premature senility of the blood vessels is most frequently not only the result of abnormal composition of their contents, but in many instances of the purely psychogenic vasomotor disturbances frequently repeated.

I have undertaken elsewhere the individual study of these spasmodic conditions which call for urgent substitution of the present preventive measures, so vague and inefficient, by a rich set of precise and practical rules (3). Between hetero-suggestion for pithiatism and psychoanalysis for other psychoneuroses, the psychotherapy for the dystonia of a simple emotional nature should be established. I propose such technique under the name of "Conscious Self Regulation", since one deals almost always with patients in possession of their volitional integrity (3).

It seems evident that in the presence of new objects and facts and of the difficult situations of civilized life, the man of to-day must not continue to depend upon his reactions based mainly on the impulses of his lower psychism as animals and babies do. That is obviously inefficient even for the regulation of vegetative functions. On the contrary, it is time that he should exercise preferably in his responses what he possesses as superior to the irrational, that is, his consciousness or higher psychism.

Primitive man comes to existence naturally adapted to the changes of the outer world. Things, events, situations of ordinary life do not call but for his spontaneous attention and for the moderate use of his senses. It is obvious, however, that before extraordinary though natural objects or circumstances, as a sudden meteorological disturbance, the presence of a wild animal, etc., primitive mind has to use voluntary attention, with the consequent elongation of its active phases and sometimes in an exaggerated manner; but it is easy to realize also that the corresponding efforts, temporary or episodic as well, will vanish without after effects. The rhythm of spontaneous attention, then disturbed only for a short while, reestablishes itself shortly after the abnormal stimulus has disappeared. The same thing might repeatedly have occurred, undoubtedly, but not often enough to produce lasting sequelae.

On the other hand no one would fail to agree that civilized man sees his attention constantly attracted by objects, facts, and situations the origin of which is not all in the physical world, but for a great part in the intellectual work accumulated by previous generations. From childhood we are submitted to a perpetual training for the adaptation of our psychophysical mechanisms to the new conditions created by social life. To them we have to oppose the corresponding psychical changes.

The excessive length of periods of fixation is, therefore, a habitual tendency in modern men, while to the primitive it is an occasional event. Who would deny that schools are the adequate places to observe innumerable psycho-physical defects and at the same time the best to prevent and correct them by applying simple rules of proper reeducation?

To keep on reacting subconsciously against the overexciting conditions of modern life is equivalent to stationing ourselves in the present period, rightly considered that of the childhood of man. If we want to speak of real progress in the adaptation of man to the complexities he encounters in his social environment, it is absolutely necessary to first accept that the conscious criterion, the only one capable of combating successfully the evils of civilization, must substitute that of the lower psychism, evidently insufficient.

A few years ago an English writer (21) emphasized the fact that despite the hygienic and therapeutic efforts of five centuries, the capacity of appreciation of our senses and the power of general coördination of our organic apparatus have gradually lowered. Hence the legion of deficiencies and shortcomings found everywhere. They are simply consequences of the habit of reacting unconsciously to new, artificial stimulations by means of blind, asynergic, sometimes anarchical reactions instead of employing the highest resources of the mind.

What would be the foundation of such a radical change in behavior? The basis previously discussed might be summed up in this unique fundamental principle: The exaggerated or abnormal contractions with which our muscles respond to the overexciting conditions of modern life, reveal a state of hypertension in the corresponding brain centers. Inversely, the absence of such central surcharge results in normal muscular relaxation. Somebody has said that "he who knows how to control his muscles, knows how to control his attention." That is an exact relation; but I would rather invert its terms and say; he who knows how to use his attention, knows how to control his muscles.

It seems necessary, therefore, to be concerned first of all with the regulation of attention, which is the initial response to external stimuli. To learn how to avoid the dangers of extraordinary excitation, nothing is more logical and more useful than to be trained, by simple and precise rules, in consciously activating the same mechanisms that the normal subject unconsciously employs in ordinary conditions. From recent data it may be inferred that "by means of the formation of conditioned reflexes, both the individual's bio-adaptation to the actual reality and his ability for defense against pathogenic causes, are obtained" (22). Also "that subjective psychical phenomena are nothing but inhibited conditioned reflexes." "The nervous energy that those reflexes give rise to is halted by the resistence of the cortex in its natural course towards the efferent paths for its discharge through the end-organs both

motor and secretory; these acquiring a certain degree of tension which would be accompanied by subjective phenomena of consciousness" (23).

Consequently, the establishment everywhere of the daily practice of the procedures already known for the regulation of attention, memory and imagination, which are derived from the very laws of the normal work of these functions, would mean a real progress in the regulated adaptation to the civilized environment. This technique should be applied as part of school work as it is easy enough to mean neither an extra burden for the teacher nor for the education budget.

The training of attention, memory and imagination by frequent exercises, including the evocation of the melodic swing while the subject looks at the artificial objects imperfectly perceived at due distances, constitutes the simplest and yet the most efficacious means to preserve and to regain the equilibrium of perception and general relaxation.

Let us remember the amount of visual activity that civilized man wastes and how he neglects nowadays his auditory memory in the formation of his intellectual wealth. Nearly all the processes of knowledge and retention are to-day made slaves of graphic note taking. Thus it is perfectly easy to understand that in the presence of the numberless data to receive and to retain in our strenuous daily existence we should preferably and often abusively employ the visual sense to fix the elements of psychical environment which are to constitute our experience. Let us not forget, however, that "auditory perception is the most dynamogenic for the organism" (24), as conclusive experiments have demonstrated (24); and that "all those people who have not yet lost their natural spontaneity, usually accompany their work with a song adjusted to the latter's rhythmicity as a matter of encouragement" (24). "In the civilized adult the movement implied by the dynamogenic and the mnemonic rhythms are inhibited by the habits of education and by the tyranny of social conventions" (24). In fact "the tendency to rhythm is a primitive manifestation in the human brain that plunges its roots in the very depths of organic life". "Mind is at the same time the disturber and the voluntary regulator of energetic explosions" (24). The *silent* and repeated evocation of an easy musical phrase changed alternatively one octave, as the one I have proposed or any similar one, helps most efficaciously in the betterment of visual perception and in the preservation of the synergy between ear and sight. But I insist on the point that such efficacy depends much more on the silent, purely mental repetition of the melodic rhythm than on its actual humming with the purpose of accompanying any other rhythmical exercise.

The correct voluntary performance of the physiological mechanisms of the mental representation is therefore the basis of the technique of Conscious Self Regulation. The sound uses of memory, of the function of utilization of the past, and of imagination, which enable us to glimpse the future, cooperate together for the exact fixation of the present instant of our physical, vegetative, animal and human life.

In conclusion may I state that:

The mere unconscious control of attention has become inadequate for the requirements of civilization. The systematic conscious application of psychophysiological principles assures perfect and continuous regulation.

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The Choice of Surgical or Radiological Treatment in Cancer

In the Mütter Lectures at the College of Physicians of Philadelphia, R. B. Greenough, taking as his title "The Surgeon and Cancer," touched on many points, among them the relative spheres of the surgeon and the radiologist in the treatment of cancer. While in favor of team-work between the surgeon, radiologist, pathologist, general physician and specialist, such as a laryngologist, neurologist or genito-urinary expert, he, perhaps naturally, considers that the general surgeon should play the leading part. The radical operation, which removes in one piece the whole of the local disease, together with the structures first in line of extension, provides the most positive and certain method for permanent cure. Mammary cancer is perhaps the best example, and, in this situation, removal of the whole breast, the pectoral muscles and deep fascia, together with the axillary contents, yields as high as 50 per cent. "cures" on a five-year follow-up in early cases in which the axillary lymphatic glands are free from infection, and even 20 per cent. in later and less favorable cases in which the disease has extended into the axilla. Unfortunately, in other situations the anatomical conditions prevent such a complete radical operation as in the case of the breast; thus the so-called "radical" Wertheim operation for carcinoma of the cervix uteri fails, and radium therapy is the method of choice for this condition. A radical operation which fails to achieve complete removal is a mistake, and though a quarter of a century ago, when there was no other remedy available, forlorn-hope operations were perhaps justifiable; now, with radium treatment at hand, such operations are ill-advised. Pre-cancerous lesions, such as the keratosis and papillomas in elderly people, are best treated by radium; but when doubt exists whether or not malignancy has supervened, especially in the lip or tongue, where metastatic growths are prone to follow, operation and pathological examination provide information which is most important for the further conduct of the case. Generally speaking, the rapidly growing undifferentiated tumors, are the most radio-sensitive, but there are many exceptions to this rule, and experience must qualify the histological predictions; rodent ulcers, embryomas of the testis, some parotid tumors, the lympho-epithelioma of Regaud and Ewing's endothelial myeloma are highly radio-sensitive; whereas squamous-celled carcinoma and fibrosarcoma are very insensitive to irradiation. Surgery and irradiation treatment supplement each other in several ways. A most satisfactory surgical measure for the relief of pain is the injection of alcohol into the sensory nerves.—(*Transactions of the College of Physicians of Philadelphia*, third series, vol. li, 245-258.)

Proceedings of the New York Physical Therapy Society

Academy of Medicine, Wednesday, May 7

A Space Saving High Frequency Treatment Table

NORMAN E. TITUS, M.D.
New York, N. Y.

Every physician who uses high frequency electricity realizes that to apply these treatments in his office it is necessary to have an adequate means of administering these currents, it is necessary to have a machine which generates the high frequency currents of today, a wooden table on which to administer the treatments, and if he desires to utilize autocondensation, which is so effective in many metabolic conditions, it is necessary for him to spend more money and get a large autocondensation pad. A few manufacturers still persist in putting out a small "trick" autocondensation seat cover and those doctors who have purchased them, I am sure, never were able to accomplish any decent results with these small contrivances to put on an ordinary chair. It has been recognized for years that real autocondensation can only be done with a thick pad.

It is not always convenient to keep this pad on the wooden treatment table and so it has to be stored somewhere in the office. The table, of course, may be used for examinations and other kinds of treatment but a high frequency machine itself also takes up added floor space.

Realizing the high cost of floor space in physicians' offices and the inconvenience of arranging the two or three pieces for treatment, a great deal of thought was given to overcoming these inconveniences without greatly adding to the expense. It is my pleasure to present to the New York Physical Therapy Society here in the New York Academy of Medicine, a combination of these three useful articles, making an examining and treatment table permanently arranged for autocondensation and containing, without any increase in the required floor space, the most efficient high frequency machine made. This table is long enough to accommodate anyone but a giant and is comfortable because of an extra thick cushion on top, which has the metal electrodes incorporated in it, so that it can be used for autocondensation. The head-piece of the table contains all of the controls for the apparatus, which is installed underneath, and, being raised, provides a support so that pillows will not fall onto the floor. Although pillows are banked against this support, there is no danger of any fire.

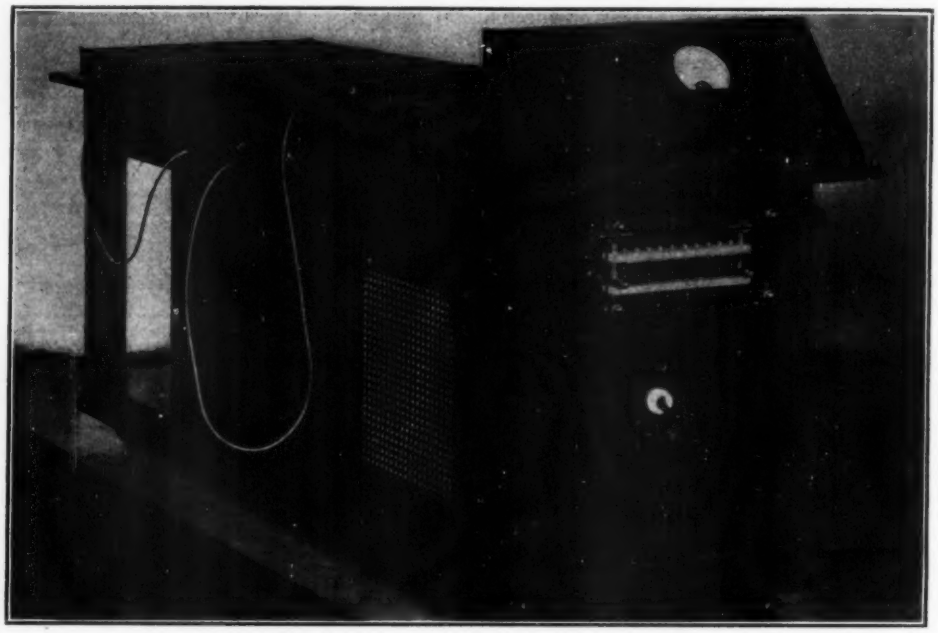
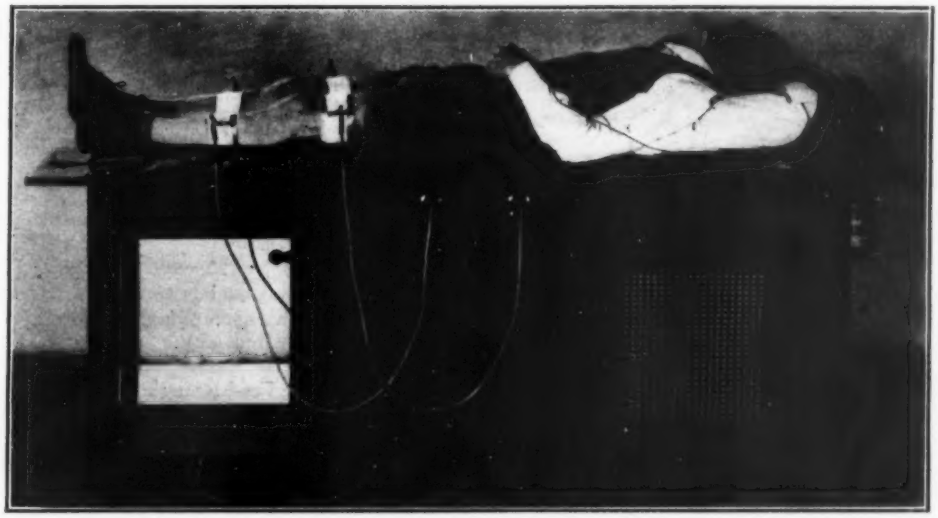


TABLE ARRANGED FOR AUTOCONDENSATION

On one side of this control head-piece there is a very strong cord connected directly to the main switch of the machine. This may be given to the patient and should he become worried about any sensations from the treatment and wish to terminate it, he may pull this safety switch cord and the entire apparatus becomes dead. The terminals of the machine come out of both sides of the table so that it is not necessary to have the table used in a single position. The spark gap may be controlled on either side and there is an additional outlet for the standard alternating current in the legs at the head of the table, so that, if desired, any other piece of apparatus may be attached thereto, such as a radiant heat applicator, an ultraviolet light, a low voltage wave generator, etc.

The terminal for the Oudin current is concealed from the patient under the foot end of the table, so that it is impossible for anyone to come in contact with it unintentionally. The table also contains two drawers: one would decrease the efficiency of the machine, although it would not seriously damage it beyond the possibility of causing a puncture of the Leyden jars.

The transformer of this apparatus yields extremely

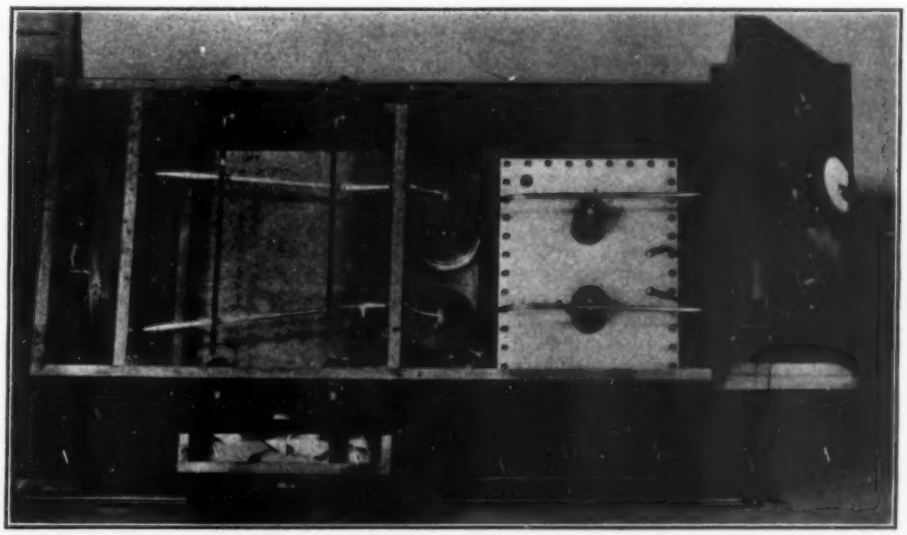


DOUBLE CUFF DIATHERMY BEING GIVEN TO TWO KNEES SIMULTANEOUSLY

of which is large enough to store all the electrodes and appliances anyone could use, and the smaller one is for the convenient storage of the more frequently used applicators.

The autocondensation pad may be removed and the top of the table removed in three sections. One side of the head part of the table may be quickly opened and all parts of the machine are readily accessible for any repairs or adjustments. Castors are fastened to the legs of the table, making it semi-portable. It is not advised that the machine be moved around as an ordinary portable machine, because, although it is not too heavy for such transportation, the condensers in this machine are saline-filled Leyden jars, which, although arranged so that they will not spill from ordinary jarring, should the machine be wheeled in and out of elevators and around a hospital, the saline might spill out. In time this high voltage, which is most essential in giving all forms of high frequency treatments. The wiring of the apparatus is replaced by copper tubing, making it much stronger, and it has been found that such connections increase the power of the machine; and, although the parts in this machine are contained in another standard model, it is found that the way they have been arranged with the tubing as conductors increases the output of this present table model.

For men who do urology or employ the electrocautery and want the use of a diagnostic lamp, it is very easy to install an appropriate transformer inside the table so as to produce these additional electrical currents. It is also being attempted to arrange a time switch control for this table, which as yet I cannot say has been perfected, of a type sufficiently reliable and small enough to install. This time switch would add to the table's



INTERIOR OF TABLE

efficiency and would be connected with the main supply and could be incorporated in or out of the circuit.

The machine presented tonight is the first experimental model made and it is not the finished product but contains all the essential details, and, when manufactured in the near future, every effort will be made to keep the cost of the entire apparatus equal to or less than the cost of the individual pieces that go to make it up. In other words, what it would cost a man to install a special treatment table, a most efficient high frequency machine and an autocondensation pad will be no more than the original cost of this entire unit, which will save a great deal of floor space.

Inasmuch as apparatus is not presented to the profession by its members for financial gain, this table is herewith presented to this Society so that it may be registered as the first of its kind.

Sanatrode Electrodes for Diathermy

CHARLES R. BROOKE, M. D.
New York

Upper extremities—In treating the fingers the electrodes are placed on ends and so adjusted that the metal surfaces are about one inch apart in center. The finger is then placed between the upper surfaces of the electrodes with tops tilted in until firm contact is made laterally the whole length of the finger. The finger is semi-flexed.

Upper extremities: Hand, wrist and forearm.—Electrode is placed on the side with posterior-anterior contact.

Elbow.—Electrode is in vertical position with arm flexed.

Upper arm.—Electrode in vertical position. Treatment may be either posterior, anterior or lateral.

Shoulder.—May be treated with or without the side arms, according to location in which the density of current is desired.

Lower extremities: Foot and ankle.—Place leg in horizontal position. Electrode so adjusted that the curved surfaces fit in hollow of foot and under calf of leg. By tilting them at various angles density of current may be varied in any part of the foot or ankle.

Lower leg.—Electrode is placed on side with lateral adjustment.

Knee.—May be treated with leg straight, semi-flexed or flexed. Better contact is produced when knee is flexed. Electrodes are applied laterally.

Thigh.—Is treated either anteriorly, posteriorly or laterally, as may be desired.

In treating the head a single unit may be placed under cervical region of the spine with soft metal on forehead.

Lumbar region.—Single unit is placed under lumbar region, with dispersing electrode in location as may be indicated.

In treating the sciatic nerve one electrode is placed under hip and the other under the popliteus.

The above instructions merely serve as a general outline as hundreds of other adjustments will be found practical.

In administering low voltage currents a very satisfactory method is to use paper towels moistened. They are convenient, sanitary and inexpensive. They should cover completely the part of the electrode that will come in contact with the patient.

This electrode will be found especially advantageous in treating weak feet with wave currents as it fits perfectly in the hollow of the foot.

After one becomes familiar with the operation of this type of electrode it should only require from 10 to 20 seconds properly to apply it.

Intra-Cervical Electrodes—Copper and Zinc

D. W. TOVEY, M.D.
New York

On accepting Dr. Richard Kovacs' kind invitation to treat my cervicitis cases in the Physical Therapy Department of the Polyclinic Hospital, I found the copper *intra-uterine* electrodes to be of insufficient diameter to dilate the arbor vitae of the cervix, and that unless great care was exercised, the upperpart of the electrode passed into the uterine cavity, caused colic, and a delay of menses from ten days to two weeks. The majority of the intra-uterine electrodes on the market are useless and dangerous to use in the treatment of cervicitis. The small diameter makes it impossible to use them in the cervix without entering the cavity of the uterus. The highly specialized endometrium is not involved, and cannot be injured or destroyed with impunity. The pathology is the cervix. Endometritis *per se* is very rare. The uterine pathology is a lymphangitis in the muscle walls, not endometritis. Infection originates in the cervix.

The *intra-cervical electrodes* shown, are from 16 to 28 French in diameter; 4 centimeters (an inch and a quarter) long. The small rounded end enters the internal os; the shoulder of the bulbous *intra*-cervical part prevents it from entering the uterine cavity, unless undue pressure is made.

The electrode dilates the cervical canal bringing it in contact with all of the mucosa, and gives the maximum quantity of current in the region of the infected racemose glands, which extend three-quarters of the distance to the internal os. The small upper end allows enough current to reach the infected mucosa and tissues in the upper quarter of the cervix.

Copper salts are deposited in the coagulation area about the electrode, and driven into the cervical glands and along the lymphatic drainage in the uterine walls and tissues of the broad ligaments. Infection is carried by the ligaments in the same direction. (The lymphatics may be traced from its lacunal origin in the cervical mucosa, through minute funnel-shaped ostia into the myometrium. Here it branches into an extensive capillary net which spreads on the perimysium, penetrates and enmeshes every bundle and fascia of the musculature to its subperitoneal surface, whence it drains into channels that

course parallel to the uterine and ovarian blood vessels at the bottom and top of the broad ligaments.)[1]

I have found copper ionization of the infected cervix a safe and efficient substitute for cauterization. Treatment of thirty cases made operation unnecessary. Neither the late atresia nor the alarming hemorrhage reported in the literature following cauterization were seen.

Discussion of Instruments and Apparatus Presented:

DR. HARRY E. STEWART: I would like to ask Dr. Titus how much these tables cost. They certainly conserve space.

DR. RICHARD KOVACS: Each of these devices deserves favorable comment. The diathermy electrode appears very desirable as a universal diathermy appliance. However, with the technic shown, I doubt whether it will give efficient diathermy to the ankle joint, for it places the back of the ankle joint and heel in the shortest path of the current; but for most of the joints it seems satisfactory, and I would like to have the opportunity of trying it in my clinic.

Dr. Titu's table looks like a desirable space saver. Perhaps it could be made so that those who already have the apparatus could make it fit into the table. I would also like to know the cost of it.

DR. A. B. HIRSH: An instrument somewhat like Dr. Brooke's electrode is made by the Wappler Company for the application of diathermy to the shoulder but is not suitable for application to all parts of the body. This electrode, as an improvement, can be used for various parts of the trunk and extremities.

As for Dr. Titus' table, it is well known that one of the objections of the family practitioner to the use of physical therapy is the variety of physical appliances that are needed and the space required for them. This combination table does away with much of that objection.

DR. W. H. GUILLIUM: I would like to ask Dr. Tovey how he uses the second or indifferent electrode with the internal one—if he finds the straight one does as well internally as the slightly curved one?

DR. DAVID DEROW: I have had some experience in the treatment of endocervicitis for the past eighteen years. I cannot agree with the implication that there is nothing in the literature on the copper-ionization treatment of endocervictis. In some of the older books on eloctrotherapeutics, such as that of Neiswanger and that of the late Dr. Massey, there are excellent detailed descriptions of the technique and the results in this type of patient.

That Dr. Tovey's electrode is new, I will admit. However, I cannot see how this electrode can be introduced without first dilating the cervix, a very painful process in the majority of cases that come up for treatment. I am sure that as Dr. Tovey has occasion to treat more of this type of case in the future, he will change the size and shape of his electrode to more nearly suit the anatomy of the parts concerned.

DR. W. BIERMAN: The instruments presented show a great deal of ingenuity, and the electrode shown by Dr. Brooke is of great interest. Those that I have been working with in hospitals and private practice consume some time in fitting them to the parts, and I have not been satisfied with the mesh electrodes. My own experience is against them, and the idea of shaping these electrodes as we have seen is very clever. I have much admiration for the ingenuity displayed in these devices.

DR. C. R. BROOKE: I wish to thank Dr. Kovacs and Dr. Hirsh for their remarks. The manufacturer of the electrodes is Mr. Charles Willard, who has made up a limited number of thsee sets, and at present the cost is $15.00 a set. I have had the privilege of using them in the Veteran's Bureau Clinic and at the Medical Center for the past month, and have found them very practical. The great advantage they offer is the ease of application and wide range of adaptability. It is true, as Dr. Kovacs said, that they cannot make direct contact with certain parts of the body; but it has been found that incomplete contact is not a drawback, for there is no sparking or arcing of the current from them. We have repeatedly demonstrated that the greatest amount of heat is produced in and around the ankle by the application of one electrode to the bottom of the foot, and the other on the leg. The outstanding feature seems to me to be the diathermizing of the foot and finger joints, as it is a well known fact that such areas are difficult to diathermize properly. Thus far the name chosen is the Sanatrode electrode. We have made a few improvements since the original ones, and perhaps more can be made, but they are the best I have yet seen for the universal application of diathermy.

QUERY: Why not call it the Universal electrode?

ANSWER: That is a good suggestion.

DR. N. E. TITUS: The manufacturers have not announced what the cost of these machines will be. Of course, the first model will be more expensive than succeeding ones. The apparatus inside of this machine is not of the portable type but is a standard large machine made in the portable form. I neglected to mention that one point we considered in designing this machine was to purposely place the spark gap outside and underneath so that not only is it insulated from the operator but also is away from the patient's head.

DR. D. W. TOVEY: The Doctor asked why the electrode was not curved. It is not curved because the cervical canal is straight. It would be hard to pass a large curved electrode. If the external os is too small to allow the electrode to pass into the cervical canal, the negative current softens the tissues about the external os, the point of the electrode is inserted, and in a few minutes the electrode can be passed into the cervical canal to the internal os. The positive pole is used for 20 minutes—8 to 12 milliamperes.

I could not find a copper electrode suitable to treat cervicitis. As I said before, they are all useless or dangerous. The intrauterine electfodes in use at the N. Y. Polyclinic pass into the cavity of the uterus, cause colic and delay the menses. The members of the Electrotherapeutic Society may have been using intracervical electrodes of copper, but you have kept it quiet if you have, and they are not on the market—and not mentioned in the literature. The treatment of cervicitis by copper ionization is not in the literature. I have searched the gynecological literature and textbooks, and there is nothing about the treatment of cervicitis *per se* by copper ionization. I am the first to report the treatment of cervicitis *per se* by copper ionization. Copper ionization as a treatment for so-called endometritis has been used for years, but not for cervicitis *per se*. All my gynecological friends are buying up the second hand galvanic wall plates to treat cervicitis by copper ionization. The cautery gives disappointing results. I claim copper ionization to be a safe substitute for the cautery. Reports are coming in of late stenosis, and alarming hemorrhages following the use of the cautery for cervicitis. Operators never see their bad results; they report the bad results of the other fellow. In my paper read bofore the Academy Section on Gynecology, April 22, also before the New York Polyclinic and West Side Societies, shortly to be published in the *New York State Journal of Medicine*, the technique is given—copper electrode in the cervix, positive pole; negative asbestos pad under the buttocks; 8 to 12 milliamperes for twenty minutes.

[1] Sturmdorf A. Gyneplastic Tissue.

Subphrenic Abscess

From a review of the literature and the study of 41 cases of subphrenic abscess observed at the Presbyterian Hospital of Chicago, Gatewood finds that the mortality in these cases is still far too high—30 per cent or more. True primary subphrenic abscesses are very rare. Most secondary abscesses are the result of direct spread of infection from such sources as perforation of the stomach, appendix, or gall-bladder, or they form as walled-off abscesses in general peritonitis. In the author's series perforation of the stomach or duodenum was the cause in 14 cases, extension of infection from the appendix in 10 cases and from the liver or gall-bladder in 7 cases. The importance of prophylactic treatment cannot be overemphasized. Early diagnosis of appendical and other contributory causes will prevent the formation of many subphrenic abscesses. In all lower abdominal infections adequate drainage and the adoption of the semi-sitting posture are the two most important preventive measures and should not be forgotten. One should not fail to consider the likelihood of subphrenic abscess in any patient not doing well after an abdominal operation, even though performed months previously. The diagnosis in early cases is ordinarily not difficult. Fever of the church-steeple variety, chills, and sweats are significant. Hiccough is always a suspicious sign, although it occurs in only about half of the cases. Cough mentioned by a number of authors was present in but few of the cases in this series. Other symptoms are shortness of breath, difficult breathing, and epigastric pain. Physical examination usually reveals flatness on the infected side; breath sounds may sometimes be detected through the flattened area. Air in the abscess cavity may give a tympanic note instead of the flatness. Bulging in the epigastrium or on the affected side in the region of the lower ribs occurs in most late cases. Edema and redness of the overlying skin is frequently observed. The liver is usually displaced downward; the heart may be displaced upward, but never laterally (Tuft). The Roentgen rays give the most important information upon which to base the diganosis; the diaphragm on the affected side is shown smoothly elevated. The treatment is essentially surgical as soon as a definite diagnosis is made, the method of approach being governed by the findings in the individual case. In the author's series 38 patients were operated upon, 27 being opened abdominally and 7 transpleurally.—*American Journal of the Medical Sciences*, September, 1930, clxxx, 3.

The Direct Current

WILLIAM T. JOHNSON, M.D.
Philadelphia, Pa.

The Direct Current is worthy of more attention than has recently been accorded it in some quarters. All attempts to understand electricity must start with a consideration of its purest form—the Direct Current. The most penetrating studies of the nature of matter have aroused at least strong suspicion that it is composed of positive and negative electricity and nothing else. Hence the Direct Current may be at the bottom of more than the so-called other currents, and supply the actual building stones which are variously grouped in the mosaics of our material universe. All other electric currents are best explained by imagining our working material —the Direct Current—put through a variety of paces by interruptions, reversals, accumlations, inductions, and modifications of pressure and volume.

Modern apparatus for newer types of treatment has diverted some of our attention from the Direct Current, possibly with a loss to patients ond ourselves. To avoid unwarranted expectations let me say at once that I have nothing radically new to offer. But the story needs retelling. May I not enter in my own defense Rudyard Kipling's justification for repetition:

> When 'omer smote 'is bloomin' lyre
> He'd 'eard men sing by land an' sea
> An' what he thought 'e might require
> 'e went an' took—the same as me!
>
> The market girls an' fishermen
> The shepherds an' the sailors, too,
> They 'eard old songs turn up again,
> But kep' it quiet same as you!
>
> They knew 'e stole; 'e knew they knowed
> They didn't tell nor make a fuss,
> But winked at 'omer down the road
> 'an 'e winked back—the same as us.

Authorities are not quite in agreement as to the nature of the Direct Current. Cumberbach, whom we may believe represents the Continental view, presents the following picture: In the process of solution molecules divide into two parts, each with an electrical charge. These charged parts are ions. Many molecules remain intact. The ions roam freely about in the solution, repeatedly combining and separating, but never reaching a state of complete stability. When a Direct Current is flowing through the solution, the ions move steadily from the pole with a similar charge, to the vicinity of the pole with the opposite polarity. These streams of ions are the electrical current. When the current is applied to the body this ionic migration is composed of many ions—Na, K, Fe, Ca, Cl, phosphoric ions, etc. When any ions reach their polar goal, their charges are lost and they become free uncharged atoms. Water will move from positive to negative, the regions of the poles showing dryness about the positive and wetness about the negative.

According to Massey and Morse the conception should be: An electrical current in solids is a flow of electrons from atom to atom. In a liquid with a binary compound in solution, i.e, a molecule composed of two ions with opposite charges—a deficiency charge or an excess charge of electrons—an electrical charge in excess of 1½ volts will overcharge an ion in a molecule, causing it to rotate and pass its excess electrons to the opposite ion of the next molecule, which by a similar rotation passes its deficiency backwards, thus resulting in a forward progression of power.

As either of these plans supplies the requisite ions when and where needed for the well known polar effects, it may not be important which we prefer. Probably the majority of us favor the latter, and are in the habit of thinking of an electrical current as a stream of electrons.

How is it possible to secure a sufficient supply of electrons for the world's work without wrecking the atom? Probably a limited number of electrons may be withdrawn from or added to an atom without disrupting it, leaving it in a condition of ionic stress. The physicists also find it convenient to predicate a supply of free electrons—possibly as a sort of buffer against a too intimate approach to the nature of things—which may be marshalled for the parade we are considering. But in actual practice a comparatively small number are required. If the positive and negative charges believed to exist in the atom could be separated and appropriately placed to exhibit their full power of attraction or repulsion, the force inherent in two cubic centimeters of metal would be a million million million tons. So our strongest electrical currents are making an almost incomprehensively trifling encroachment on the power possibilities.

The sources of Direct Current in common use are storage batteries and dynamos. The battery current of course is preferable but the convenience of the dynamo makes its use more general. The lack of perfect smoothness of current from the latter source is not a large objection to its selection. But if large amperage is employed there is danger of severe shock from an interruption of the current.

The action of the positive and negative poles, although theoretically opposite, is not quite mutually exclusive in the production of sedation and stimulation. This is self evident when the current approaches a strength that would cause destruction of tissue, for by no stretch of imagination could the severe acid destruction at the positive pole be classed as sedative. The most marked differences are seen when the meter reading shows less than six to eight milliamperes per square inch of electrode surface in contact with the skin. Tolerances are variable, making it important always to start at zero and gradually increase until the desired effect is reached.

Certain clinical, physiological and chemical effects of the Direct Current, either in its pure form or modified by waves or interruptions, are well known, and many of them have an adequate explanation. It is of course easier to observe and explain results when the investigation is conducted with devitalized tissue.

The effects on living tissue, such as production of heat, vasodilation, vasoconstriction, sedation, stimulation, fatigue relief and the production of motion are familiar to us all. Probably they are not due entirely to the ions introduced. There is much uncertainty about the mechanism of vasodilation, vasconstriction, and the changes in conductivity and irritability. The relief of fatigue is usually attributed to the dissociation of sarcolactic acid. It occurs in the vicinity of the negative pole. A phenomenon probably closely related to this is the finding emphasized by Crile that fatigued tissue

has a positive electrical reaction, whereas normal tissue is negative.

The negative pole is useful in promoting the absorption of inflammatory products, especially those of traumatic origin. If the cause is other than traumatic, it should be removed before one could expect much from the treatment. The production of heat within the tissues, somewhat comparable to a mild diathermia, aids in this accomplishment. The increased water content of the tissues in the vicinity of the negative pole and their increased alkalinity favor the same action; the water giving the opportunity for better absorption, and the alkalinity at least reversing the acid condition in which many if not all deposits are precipitated. If infection be present the Direct Current should not be the method of choice for attempting to remove these products, although microorganisms go toward the anode, and are destroyed if they reach it.

The introduction of ions into the tissue for medicinal effects has rather small possibilities. The great early expectations as to the value of such treatments have not been fulfilled. Not only are we limited in the number of remedies susceptible of such introduction but their behavior militates against any extended use in this way. Ionic penetration along the path of the current is but slight except with the lightest ions. Others quickly form insoluble compounds very near the surface and remain there. Each ion has a definite rate of penetration which is roughly proportional to its atomic weight, but even with the hydrogen atom the rate is slow. Hence long applications must be given. There are differences of opinion regarding the requisite current strength for the best penetration of ions. Living tissue is not penetrated to the same extent nor exactly according to the same laws that experiments show to occur in non-living preparations. Nor is there any agreement regarding the most suitable strength of the solution employed, the evidence seeming to favor the use of the weaker solutions. It is believed that ionization is accomplished during the process of solution and not by the action of the current. But although an ion is moved along the path of the current, only in the immediate vicinity of the pole with an opposite charge is it freed from the hookup that prevents it from resuming its stable molecular relation.

When the Direct Current is interrupted or its strength quickly modified, muscular contractions follow, presumed to be due to a sudden rearrangement of ions in a way similar to the change responsible for voluntary motion. Slow interruptions, those giving a Leduc current, or surges of great variety are available. A wave of sinusoidal form with the cycle swinging to alternate polarities gives greater effect than an undirectional wave, because of greater polar differences.

The use of the Direct Current in the study of the Reaction of Degeneration is too well known to require any extended review. When the reflex arc is blocked the typical sluggish contractions, usually of abnormal size, are found. The diminution or loss of response at the muscle point and its greater strength or appearance nearer the insertion of the muscle are often overlooked. When R.D. exists this current is of supreme importance, as it supplies the best means of exercising the affected muscles and maintaining their integrity until the nerves are capable of resuming their function. Modern apparatus supplies suitable waves and surges for these applications.

In all paralyses, and especially in those associated with R.D., the muscles are weakened, and the danger of fatigue from prolonged treatments or too rapid contractions must be avoided. It is worse than useless to risk exhaustion by causing contractions at a rate faster than the muscle was accustomed to working when in its normal condition.

Since the advent of high frequency currents the surgical uses of the Direct Current have suffered an unwarranted neglect. With appropriate operating instruments attached to the properly selected pole a surprising variety of conditions may be successfully treated. The negative needle is the only tool that will give us perfect results in treating hypertrichosis. It is common practice to use too much current and incur the risk of producing scars. If a very fine needle is used, careful insertion assured—the operator wearing magnifying lenses—and one half to one m.a. employed according to the tolerance of the skin, some hairs may return, but the final result will be most gratifying. Moles containing prominent hairs should be attacked in the same way but with a current of slightly greater strength. There is no objection here to destroying all the hairs at one séance for we cannot avoid causing some scarring. Have the patient return a week later and if any of the mole remains destroy it as you choose; but any other type of destruction that reaches the hair bulbs is likely to leave a depressed scar. Pigmented areas of the skin may be cleared up by a similar procedure, the needle here being inserted parallel with the layer of pigment. Small skin varicosities should be treated in the same way. The port wine mark may require multiple needles. Care must be taken that a steel operating needle is never attached to the positive pole. Tattooing results.

Surgical ionization of ulcers and tuberculous sinuses often gives brilliant results. For this purpose a Zn or Cu electrode is selected, with or without a Hg amalgam on the surface, attached to the positive pole and so applied that all surfaces to be treated are in actual contact with it. Current strength should be well within the patient's tolerance and the application must be continued long enough to permit as much ionization as can be produced.

Dr. A. Reiss, of Philadelphia, some years ago related the following experience. A patient with multiple infected varicose ulcers of the legs applied for treatment. It was decided to select the worst ulcer and see what effect could be obtained by using a solution of copper sulphate on a positive pad covering the ulcer. A few applications resulted in the healing of the ulcer. The surprising outcome was that all of the untreated ulcers healed at the same time. Attempted explanations were: the elaboration of an autogenous vaccine as a result of the dead bacteria remaining in the tissues, and the reaction from the absorption of non-specific protein from the devitalized tissues.

The best practice of gynecology requires frequent use of the Direct Current. Excellent results follow negative vaginal applications in infantile uteri, and in the amenorrheas of constitutional origin or relations. Subinvolution and prolapse are benefited by the tonic effect of similar treatments. Endocervicitis not of gonorrheal origin responds satisfactorily to the use of a copper electrode attached to the positive pole and inserted within the cervical canal. When making intrauterine applications disease of the appendages and malignancy must be excluded.

The use of a negative electrode for atresia of the uterine canal should be guided by the same principles that apply to the treatment of strictures. A free passage for the electrode may be made quickly if sufficient current is used to destroy tissue. Not only is nothing gained but harm may follow such procedure, for a scar with

its contractile possibilities will result. The effect to be produced is softening of the stricture by the action of the negative pole, giving a comparatively long treatment but carefully avoiding any destructive action. It is well to remember that the Direct Current in sufficient strength at the negative pole has an action that might fairly warrant its inclusion in the cutting currents.

Many thousands of cases from the ophthalmologic clinic of Dr. L. Webster Fox have received applications of this current. Atrophic conditions were stimulated, and in cases with possibilities of improvement or recovery, as the tobacco amblyopias, excellent results were often obtained. The pain of iritis was eased with the positive electrodes. Abnormally placed eyelashes were removed with the negative needle.

Familiarity with the possibilities suggested enables the physician to attack a large number of conditions in many branches of medicine and surgery. In such a fragmentary review as this any extended discussion of technic would divert us from the main principles that it is hoped have been usefully emphasized.

Let me illustrate the value of acquaintance with the Direct Current by relating two instances that recently came to my attention. Dr. Barton Cooke Hirst had a patient with post-operative flatulence approaching a condition of ileus. Prompt relief was afforded by using a rectal electrode attached to the negative pole of a small battery, with a large abdominal pad connected to the positive pole, and stimulating peristaltic action by sudden makes and breaks of the current.

Dr. Wm. L. Clark reports being called by a prominent urologist to see a patient suffering from an alarming hemorrhage the source of which was broken varicosities in the posterior urethra. Attempts at hemostasis by using a desiccating high frequency current had failed. The cystoscope was flooded and the bleeding points could not be identified. Treatment through an appropriate sound attached to the positive pole stopped the bleeding, which did not recur.

We are not in the habit of recognizing that the Direct Current may have life-saving possibilities, but such results as these show that it may succeed when all else fails. Any physician will have his preferable tools; but it behooves us all to retain this current in our treasure chest, for again and again when a new problem is presented, nothing else will do.

2008 Walnut St.

Discussion of Dr. Johnson's Paper

Dr. Frederick H. Morse: I was brought up, electro-therapeutically speaking, with the prominent teachers along that line, namely, Robert Newman, Prof. Herdman, Morton, Massey, Bishop and Goelet, and the fundamentals of the galvanic current were so instilled into me that I have been a strong adherent of it as a valuable part of my everyday work.

Dr. Massey called the wave and waveless galvanic current the modality to be used where one desired to get a more forcible and added impulse at the negative pole, which has a wide range of application.

A book of one hundred illustrations showing how to apply electrodes when using low voltage currents is about to be published. I have written the book on the principle that Doctors will look at a picture when they will not take the trouble to read descriptive text.

The designs on the blackboard are to show how the careless placing of electrodes on the body when using the galvanic current may not be productive of all the results expected. For instance, if a copper electrode is placed into a cervical canal for the treatment of endocervicitis as indicated by the Doctor who preceded me, and if the surface or indifferent electrode is placed only on the abdomen or only on the back, only one half of the cervix will receive the benefit of the deposit of the oxy-chloride of copper. But if the current is divided by using a bifurcated cord for the external electrode, then the current will be equally distributed throughout the canal. This also applies to making applications in the vagina or rectum where it is desirable to have a general distribution of the current; or if metallic electrolysis is used, the principle is the same, the exception being where only some small area is to be treated on one side of the canal; then the external electrode should be so placed that the diseased spot will receive the fullest benefit by having the current go directly through it. Physicians often through carelessness in treating, for instance, a urethral stricture will place the indifferent electrode on the hand or some convenient part of the body, instead of the lumbar region where it should be. Another instance would be placing two electrodes on a knee to treat synovitis, and by careless binding allowing one electrode to come so near the edge of the other that the current is practically short-circuited, so that the knee fails to get the benefit.

Another form of technique which should not be allowed is moving galvanic electrodes over the surface of the body anywhere, as one will fail to get the penetration that the current demands; also motor points will be constantly encountered, causing unnecessary shocks.

Still another is the placing of electrodes, especially for the galvanic current, on the palms of the hands and soles of the feet while the resistance is so great and the penetration so feeble that little would be likely to be accomplished. If it is easier to use a current through the feet or hands, the current can be used through a saline solution or with an electrode on the feet or hands and the top of the foot and the back of the hand covered with wet chamois or sponge, which is bound in with the soft part of the regular electrode.

Dr. Snow and I have had many talks and arguments about the comparative value of galvanic and static electricity, and he tells me he is writing something that will do much to prove that, on account of the polarity of static electricity, results similar to those of the galvanic current may be produced.

This analogy being accepted, the better one understands galvanism, the easier it will be to appreciate Dr. Snow's ideas.

Dr. W. Bierman: I am afraid our tendency is to get away from the direct current, and we need such a presentation as we have had to understand its application. There is no one who has done more with the direct current than Dr. Snow, and I will call on him to take part in the discussion.

Dr. W. B. Snow: I did not expect to speak tonight, but I am gratified with the papers and the proper way suggested for employing the constant current. We used to hear it advised for treating arthritis, neuritis, and constitutional derangements, but now the general trend is getting back to employing it for the local effect of the two poles. The burden of Dr. Johnson's paper pointed in that direction, which is right. As Dr. Johnson said, we have been replacing the constant current with desiccation or other methods for destroying various redundancies as moles and warts. If we go back and review the literature of the constant current and study the work of Massey in treating malignancy by ionic action, and the general uses that passed into decadence when he substituted the better methods, we will recall also how he advocated it for the treatment of fibroid tumors and later gave it up for the *x*-ray method. No matter if Dr. Massey had a hobby, he was broadminded and was always in line to adopt the better methods.

We must all believe in the survival of the fittest. The thing that does the work best is the thing that should be used for the particular purpose for which it is indicated.

I was much interested in Dr. Morse's idea in placing the different electrodes. I never heard anyone advance that idea as he did. Our English friend, Cumberbatch, puts the indifferent electrode around the body, his idea being to have the current pass in all directions. I never thought it was necessary when I treated stricture and various other troubles. We thought that was getting the desired effect on all sides, but Dr. Morse with his large experience thinks otherwise.

One method of importance not mentioned is the use of the positive pole with a copper electrode for the treatment of fistula. I know of no means that will better cure a rectal fistula than that method. There are many failures with the surgical method because the fistula is not removed. They expect it to heal from the bottom when the fistulous tract has not been destroyed. In every case the positive pole should be used first to destroy the fistula and then the operation will be in order. I am greatly pleased that the present trend of the use of a constant current is back to its polar effect, instead of what we used to hear so much of in years past.

Dr. Richard Kovacs: Beginning with its discovery by Galvani in 1780, the history of galvanism is a fascinating chapter to the student of electrotherapy. Towards the latter half of the last century galvanism came into extensive use for many lesions of the central and peripheral nervous system, for gynecological and genito-urinary conditions, and later in the form of electric ionization, for the introduction of medicinal substances through the skin. One by one, all of these methods, the description of which occupied so much space in contemporary medical literature, fell into disuse; with a better understanding of the pathology of the

(*Concluded on page* 382)

Medical Times

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NEW YORK, DECEMBER, 1930

An Announcement

As an independent journal the MEDICAL TIMES has won the confidence of twelve thousand individuals; now this confidence is also expressed by a number of bodies representing organized medicine.

The Associated Physicians of Long Island, now a geographical center of seething activities in the medical sphere, is the fifth organization to register this confidence in one way or another. But in the last case an unusually significant recognition is involved, for the erstwhile organ of the Association, the *Long Island Medical Journal* itself, becomes, on January first, 1931, of one flesh with the MEDICAL TIMES. The new publication resulting from this consolidation will be known as the MEDICAL TIMES AND LONG ISLAND MEDICAL JOURNAL.

The vigorous life of this young publication—its first issue appeared twenty-four years ago—has been such as to give a decidedly eugenic aspect to its marriage with the MEDICAL TIMES. The professional progeny of these two trustees of the written word, who will address continents and hemispheres by reason of the far-flung and increased circulation of the new journal, should be a signally significant brood.

Growth is the law of life. The "metabolism" of our hospitals, medical schools, societies, medical libraries, clinics and centers is becoming more and more dynamic. Not the least factor making for improved professional metabolism is the sixth—the medical press. That the MEDICAL TIMES has entered the fifty-ninth year of its life better endowed than ever with those elements which enable a publication to compete successfully in a changing world, is due to its adaptability to that world, its readiness to give and take, as shown in the present merger—for realists a significant sign of the times, medically speaking. There is a fine challenge in all this to the forces of organized medicine and independent journalism to go along together in a new way—for extremes to meet, if you like, and the courage that aims at better things to be well tested. The good of medicine itself should be the first, last and only consideration.

Through the medium of its exchanges the consolidated journal will reach the remote corners of our own nation and practically every foreign country, thus making its contents available to a world-wide field. The Book Review Section, heretofore especially featured in the *Long Island Medical Journal* and recognized for the high character of its book notices, will in the combined journal not only maintain its special individuality and arrangement but will be considerably expanded.

Five Editorial Representatives of the more than eight hundred members comprising the Associated Physicians of Long Island will co-operate with the editor in carrying on the fine tradition created by the past directors of its organ—the lamented Pilcher and Webster, Overton, at present Editor of the *New York State Journal of Medicine*, and Thomson, now editing the *Long Island Medical Journal*. These five Editorial Representatives will be William H. Ross, M. D., President of the Medical Society of the State of New York, of Suffolk County, Arthur Chalmers Martin, M. D., Ex-President of the Medical Society of the County of Nassau, Ernest Ellsworth Smith, M. D., Secretary of the Medical Society of the county of Queens, Joshua Marsden Van Cott, M. D., distinguished teacher, clinician and leader of Kings County, and Alec Nicol Thomson, M. D., Editor of the *Long Island Medical Journal*, also of King County.

So, in addition to the already great geographical character of the work done by the MEDICAL TIMES, expression will now be given, in the columns of the new journal, to the genius that is germinating and flowering in the colossal medical center of Long Island, that "Paumanok" beloved of her greatest son, one of America's immortals, Walt Whitman, who so often sang the praises of the "SEA BEAUTY! stretch'd and basking!"

The further destiny of Paumanok looms impressively in the medical scheme of things.

Discussion of Dr. Johnson's Paper

(*Concluded from page* 380)

nervous system it became known that galvanism could have little if any effect on atrophied cells, degenerated tracts or destroyed nerves; the operative era in gynecology did away with Apostoli's method of treating fibroids by surgical galvanism; restricting the use of strong astringents in gonorrhea resulted in less occasion to treat artificial strictures by negative galvanism; the final blow came when the much heralded results of drug ionization proved to be due rather to the passage of the galvanic current and to mild superficial counterirritation than to the specific action of the drug employed. Still, no lesser authority than Dr. Franklin H. Martin of Chicago, himself an author of a volume, "Electricity in the Diseases of Woman and in Obstetrics," published in 1893, told me in the course of a conversation that he still believes in the value of Apostoli's galvanic method in treating some fibroid tumors and that he abandoned this method only reluctantly.

Galvanism must be regarded as the basic modality for the conception of the effects of all other electrical currents; with a better understanding of its important chemico-physiological action and with the powerful and efficient dry batteries now available, there is no question that galvanism enters now an era of renewed usefulness. As to the polarity effects which were emphasized, I am afraid there is some confusion. We may classify therapeutic galvanism in three forms. First: Medical galvanism, which applies galvanism within physiological toleration for local stimulative and metabolic effects; when equal size electrodes are used, the amount of local hyperemia is equal under each electrode, and it makes very little difference to which pole either electrode is attached. The physiological teaching about electrotonus states that there is an area of increased irritability around the negative pole and an area of decreased irritability around the positive pole, but all this relates to an isolated nerve of a laboratory animal and cannot be transferred to patients whose nerves lie imbedded deep down in the tissues. It is a fallacy to expect a specific pain-relieving action of the positive pole under such circumstances. The second form of galvanism is iontophoresis, or medical galvanism, in which polarity is important because drugs have to be applied at the pole of the same chemical affinity, in order to be driven into the tissues. Finally, in surgical galvanism, polarity is also of paramount importance, as the active pole is used for destructive purposes, the results of which vary in accordance with the polarity.

The question of a belt electorde is not so simple as some of the speakers would make it appear. A belt electrode around the pelvis does not guarantee an equal distribution of the current all around the electrode in the cervix, because the bulk of electricity always travels the shortest path, and there is bound to be a shorter path either towards the front or the back, and most of the current will travel along this path. I feel that a dispersive electrode, either above the symphysis or under the buttocks, is quite sufficient, and inspection of the cervix after completing the copper ionization shows a circular green discoloration all around its lumen, proving a fairly equal distribution of the current in the immediate vicinity of the active electrode.

Dr. H. Stewart: I was very much interested in the paper by Dr. Johnson. We have learned to expect much from him. A short time ago I checked up the use of the word galvanism by one of the professors who teach in our school; he said there is no justification in language for using "galvanism" or "faradism." The point that Dr. Kovacs made is very good indeed. We do get selective polar effect when the application is a surface one. Deep down, we have peri-polar zone effects, and it is very hard to tell whether the tissue is affected by the active electrode, so for that reason the negative pole along the sciatic will sometimes give better effects than the positive. We believe that no deep "ionization" is possible. There is no such thing as drug effects, deep within the tissues. When you can get selective polar reaction and complementary drug action in the skin or ulcer surfaces you get a very good result. Most of our excellent results are where we get the combined effect of polarity and drug action.

Dr. W. H. Guillium: I am sorry that Dr. Tovey could not remain long enough to have heard and taken part in the discussion of Dr. Johnson's very interesting paper on applied galvanism.

He made a statement that he could not find anything in the literature about the treatment of cervicitis by ionization. I feel sure that if he would peruse the writings of Drs. Snow, Pope, Massey and Wilmouth, etc., he would find many descriptions and illustrations of this subject. I think we ought to give credit, where credit is due, to the older men for their work along this line.

Regarding the straight electrode—it is not as useful as a slightly curved electrode, for in many cases it is impossible to insert the straight electrode, whereas, a slightly curved one will slide very easily into the cervix.

Many specialists are inclined to put across to their societies and the general medical profession subjects and treatments which have been advocated in our society for years, as something entirely new in physiotherapy. Very little notice is given to our results until some outstanding case comes to their immediate attention. In fact, sometimes our results are termed accidental recoveries. Like Dr. Tovey their need is to peruse our literature thoroughly, where they will usually find descriptions and treatments of similar types of cases.

Dr. Johnson, closing: Dr. Kovacs will recall that I tried to bring out the point that the polar differences were not mutually exclusive. The surface effects vary with the variation of amperage. I have certainly seen sedative effects in painful conditions—particularly in eye conditions—when the positive pole was applied with a small dose of current. This result would not follow a large dose nor the use of the negative.

The mechanics could be endlessly discussed and I will not attempt to go into that. I hope the use of the direct current will become more popular. It is not a costly procedure.

Necrology

Edward Preble

Portland, Cleveland, Wooster, New York, 1855-1930

(*Long Associated with the* Medical Times)

It is a pleasure to offer here a brief appreciation of the pioneer dermatologist of Maine. Born Jan. 16, 1855, in Dover, N. H., the son of Benjamin F. and Maria Cressey Preble, he studied at the Portland School for Medical Instruction and obtained his diploma at the Bowdoin Medical School in 1878, much interested in medical bibliography. He served as interne at the Maine General Hospital, studied post-graduate for nose, throat and dermatology, and settled in Portland in 1881, having an office on Congress St., near Brown, and then in the Elks' building of to-day. He did his best to make a living, but found it useless, because physicians would not then send patients to specialists for fear that they would steal them from their families. Regretfully he moved to Cleveland, where he married Miss Margaret Saville, thence to Wooster University, Ohio, where he taught dermatology, and from there to the New York Post-Graduate School as professor. Finally he turned his thoughts back to his graduating thesis of "Medical Bibliography," and became an expert research worker for medical publishers, who relied implicitly on his scientific knowledge covering an immense field of learning. Dr. Preble leaves a famous reputation as a man of character and of wisdom, ready for the use of all who asked of him. He died July 13, 1930.

We take pleasure in saying these few words concerning an early pioneer in dermatology in Maine, in order that younger men may personally understand the obstacles to specialists of fifty years ago, and from the final successful career of Dr. Preble take encouragement.—J. A. S., in *Maine Medical Journal*, Oct., 1930.

The Physician's Library

Proceedings of the 1929 Annual Conference of the National Society for the Prevention of Blindness. Published by the National Society for the Prevention of Blindness, Inc., 370 Seventh Avenue, New York, N. Y. Publication 65. Price $1.00.

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